Skyways

Flight Operations • Engineering • Managemen

APRIL 1953

est Pilot's Report: Lockheed F-94C

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nstrument Panel Lighting

Flight Operations

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APRIL 1953

Skyways

Flight Operations • Engineering • Management

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COVER: Lockheed F-94C is the Air Force's newest jet interceptor. It is radar-guided to target and automatically fires on the enemy.

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. . . air your views

Automatic Feathering

Gentlemen:

With reference to "A Pilot's View of Automatic Feathering", January issue, we wish to comment that we also have had very early experience with automatic propeller feathering. In fact, we have had two patents issued as a result of our efforts: Patent 2,601,902 Multi-Engine Safety Feathering System, issued July 1, 1952, from our application filed November 18, 1946; and Patent 2,601,901, Automatic Propeller Feathering System, issued July 1, 1952, from our application filed May 10, 1949. One application on both systems was filed on November 18, 1946, but the Patent Office ruled a divisional application was necessary for the second system, hence the May 1, 1949, date of filing.

CAR Part 04 (now 4b) as originally released became effective November 9, 1945. By March, 1946 we were presenting our D18C (later designated D18C-T) Model airplane for CAA approval. It was then we found it necessary to resort to an automatic propeller feathering system.

Our records reveal the following:

March 28, 1946—Mr. T. A. Wells, Vice President and Chief Engineer requested a system be installed on the Model D18C airplane to give automatic feathering of the propeller with loss of power.

April 2, 1946—A semi-automatic propeller feathering system was installed on Serial A69 Model D18C Twin Beech.

May 14, 1946—Mr. T. A. Wells wrote the CAB, our reference number 5-401, requesting permission to incorporate semi-automatic feathering in our aircraft for objective compliance with CAR Part 04.

June 6, 1946—Feathering System conference and demonstration to the CAA in Washington.

We do not agree with Mr. William W. Moss. We think automatic propeller feathering is an added safety feature and we are proud that we have been able to make this worthwhile contribution to aviation safety.

VIRGIL H. ADAMSON

Administrative Engineer
Beech Aircraft Corp.
Wichita, Kansas

We are pleased to hear of Beech Aircraft's early participation in the development of automatic propeller feathering systems, and this information has been passed on to Capt. Moss so that he may correct his records.—Ed.

Wrong Stand

Gentlemen:

The article "Business Plane Adds Profit" in the November issue was most interesting in that it dealt with the use of an airplane in business. The information was of interest to those thinking of buying an aircraft to help in their business. But . . . Pilot Abram (shown waxing the plane) could become a liability by standing that way to polish his plane.

Philip A. Block

Anchorage, Alaska

Kudos

Gentlemen:

Thank you for an excellent article on the Piper *Tri-Pacer*. I was particularly impressed by the cost of operation analysis which you included. I hope you make this a practice.

M. BELSHAW

New York, N. Y.

We intended to do that whenever possible. In some cases, however, operation costs are not available when we do the evaluations. Insofar as possible, we will bring you cost analyses as they are worked out.—Ed.

Air Traffic Control

Gentlemen:

I would like to express my appreciation for the interesting contents of your publication. Being an air traffic controller at the air traffic control center at Munich-Riem Airport, Germany, I get much useful information from your excellent magazine and it has helped me to broaden my professional scope.

HANS HOPP

Herrsching/Bavaria
Germany

ADF Reversals

Gentlemen:

I should like to make reference to an article on page 64 of the February issue, entitled "Premature ADF Reversals are Traced to Antennas." Feeling sure that your company desires to print accurate information, I would like to clarify exactly what transpired in conjunction with the ADF reversals recently experienced by Northeast Air Lines.

Extensive tests were conducted by Northeast Air Lines' radio maintenance personnel and the engineering group at Bendix Radio, Towson, Maryland. Satisfactory cure was determined and an advisory will be released to all airline users of the equipment regarding the steps necessary to prevent ADF reversals.

The CAA personnel were observers in this instance, but did not contribute as far as engineering technical help was concerned.

L. E. CLELAND

Aviation Sales Engineer
Bendix Radio Div.,
Bendix Aviation Corp.

Thank you for correcting the impression that government experts had engineered the "cure" for premature ADF reversals. We've talked with Northeast Air Lines and now plan to publish details of this trouble and its effective cure in an early issue.—Ed.

in this issue...

Jean H. DuBuque, Executive Director of the Corporation Aircraft Owners Association, recently presented a paper before the American Helicopter Society at its meeting in Philadelphia. Mr. DuBuque's article, "The Helicopter for Corporate Use," is an adaptation of that paper, especially prepared for *Skyways*. Interest in the helicopter for specialized uses in industry is increasing, and several business-plane pilots already have or are in the process of getting their 'copter tickets in anticipation of the day when the helicopter becomes a working part of their business aircraft fleets. Mr. DuBuque has been Executive Director of CAOA since late 1952. He resigned as Special Assistant to the Under Secretary of Commerce for Transportation to accept the appointment to that business-aircraft organization. A veteran pilot, Mr. DuBuque has been active in aviation affairs for 20 years, and is a member of the Institute of Aeronautical Sciences, the Air Reserve Association, Quiet Birdmen and other technical and professional aviation organizations.

▶ The owners and operators of business aircraft have expressed interest from time to time in British-designed planes, particularly the de Havilland *Dove* and more recently de Havilland's enlarged version of the *Dove*, the four-engined *Heron*. To answer some of the technical queries regarding design and construction of the *Heron* and to bring business-aircraft pilots detailed information concerning the actual operation of that aircraft, William Green has authored the article, "Design/Engineering: de Havilland *Heron*." Mr. Green has been an aeronautical journalist for several years and is no stranger to the pages of *Skyways*. During World War II, he served with the Royal Air Force, both as an air crewman and as a ground staff man, and was for some time a member of the editorial staff of Air Pictorial, known during the war as Air Training Corps Gazette. Mr. Green currently is U.K. and European correspondent to a number of leading British Commonwealth aviation monthlies, and as such is in close contact with aircraft designers and manufacturers in Great Britain and in most of the European countries.

LCDR. George W. Hoover, author of "Let's Analyze before we Standardize," made his first appearance in *Skyways* as a participant in the Flight Operations Round Table, "Cockpit Simplification and Standardization," which appeared in the December, 1952 issue. LCDR. Hoover, a native of New Kensington, Pa., and Cleveland, Ohio, enlisted in the Navy as an apprentice seaman in 1934. He graduated Flight School at Pensacola in 1938 and served aboard the *USS Lexington*, *USS Saratoga* and the *USS Enterprise*. He was designated Aeronautical Engineering Duty in 1946, and graduated with a B.S. in Physics from the University of Nebraska in June, 1951. LCDR. Hoover is now stationed at Air Branch, Office of Naval Research in Washington, and is active in the Navy's work toward simplification and standardization of aircraft instruments.

▶ Next Issue: The Flight Operations Round Table for the May issue, "Airborne Radar", is a follow-up on the "Radar Air Traffic Control" Round Table featured in this issue. Moderated by Sam Saint, Director of the Air Navigation Technical Committee of the Air Transport Association, the Airborne Radar Round Table participants include airline pilots, representatives of the Corporation Aircraft Owners Association and the Air Line Pilots Association, and representatives of several corporations involved in the development and manufacture of radar equipment.

Also in the May issue is an Executive Pilot's Report on the new Beech *Twin-Bonanza*.

test pilot's report:

LOCKHEED F-94C

by Carl B Patton

Chief Pilot, Fighter Flying
Lockheed Aircraft

Some evening when you're lighting up an after-dinner cigarette, an alert observer at one of this nation's far-flung radar outposts may pick up an unidentified "blip" on his screen. That blip might be a hostile bomber approaching our border.

This *could* happen . . . .

In less time than it would take you to smoke that same cigarette, Lockheed F-94C *Starfires* will have been alerted and airborne—up to 40,000 feet—streaking to intercept their target.

This *will* happen . . . .

I believe one rocket, fired from the over-600-mph *Starfire*, can knock down the biggest bomber ever built.

Radar-guided to a target, its two-man crew doesn't even have to see—the F-94C electronically tracks, locks on, and closes in to its quarry. The pilot presses his rocket-firing trigger. At that instant an automatic computer takes charge. Seconds tick by, and then—automatically at just the proper moment to insure rocket-target contact—the missiles are unleashed.

Two men and a machine, working as a three-unit team; that's the way I look at the *Starfire*. The machine is the F-94C itself, the men are its pilot and radar observer.

I am one-third of that team, the pilot. I test fly the ship for Lockheed Aircraft.

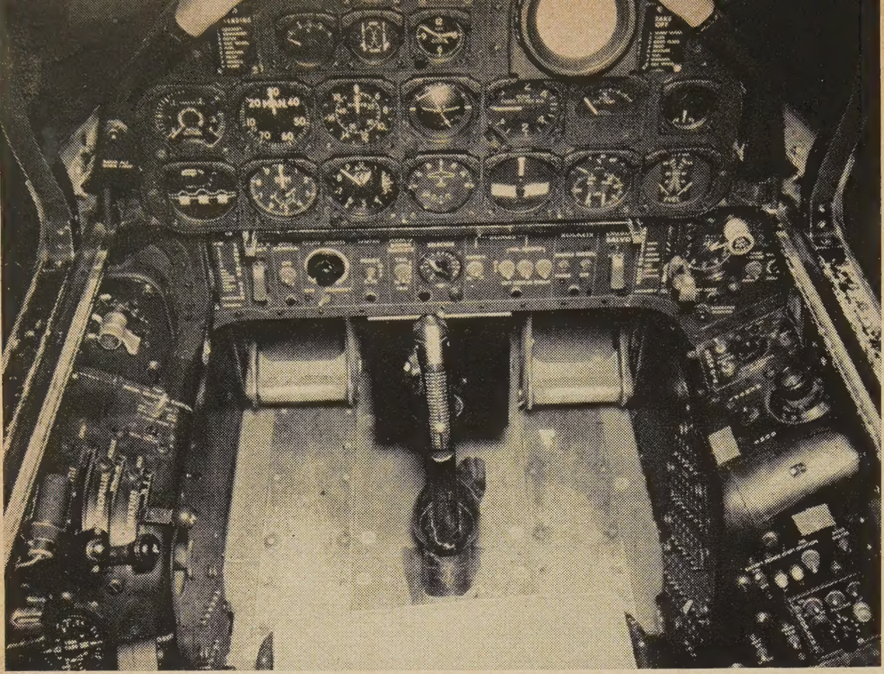
When you take about 10 tons of metal, machinery, electronic equipment, rubber, fabric, and wrap them all up in a streamlined airplane 41.5 feet long, 13.7 feet high and with a 37.6-foot wing span, you can come up with a terrific bundle of concentrated airpower. I believe this ship has got it, and here's why!

From my standpoint, the F-94C is a "good bird." It maneuvers sharply and with ease, and climbs like that proverbial homesick angel.

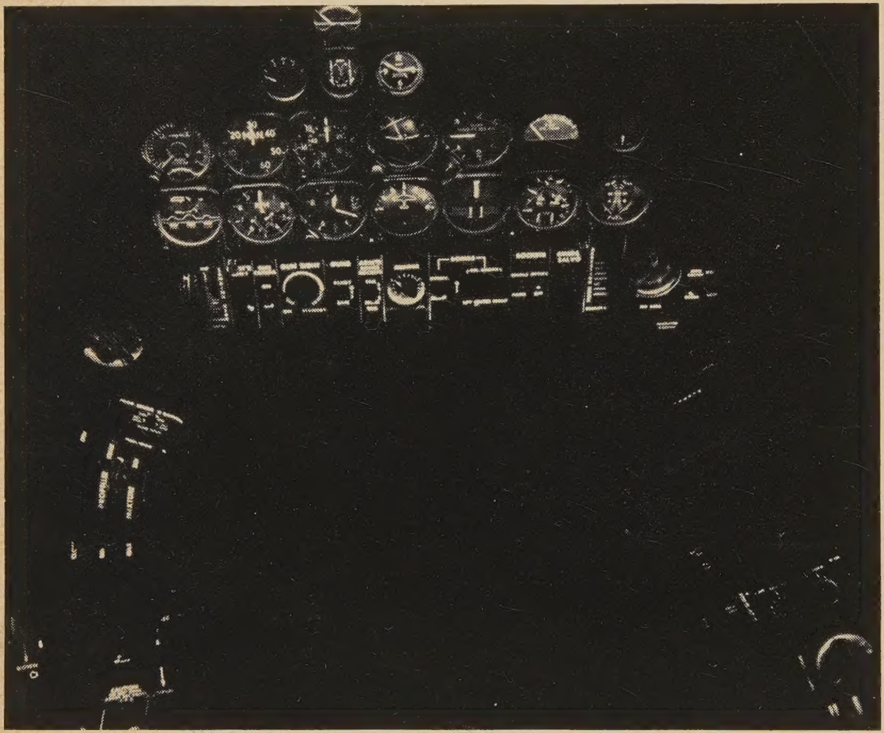
Flight in the F-94C is quiet and smooth, no vibration to speak of and, of course, no torque. The cockpit is comfortable at all times. Pressurization takes care of your altitude, and its cockpit heating and cooling units are excellent. I've heard it *(Continued on page 58)*

AUTHOR *Carl Patton states, "one rocket fired from '94C can knock down biggest bomber"*

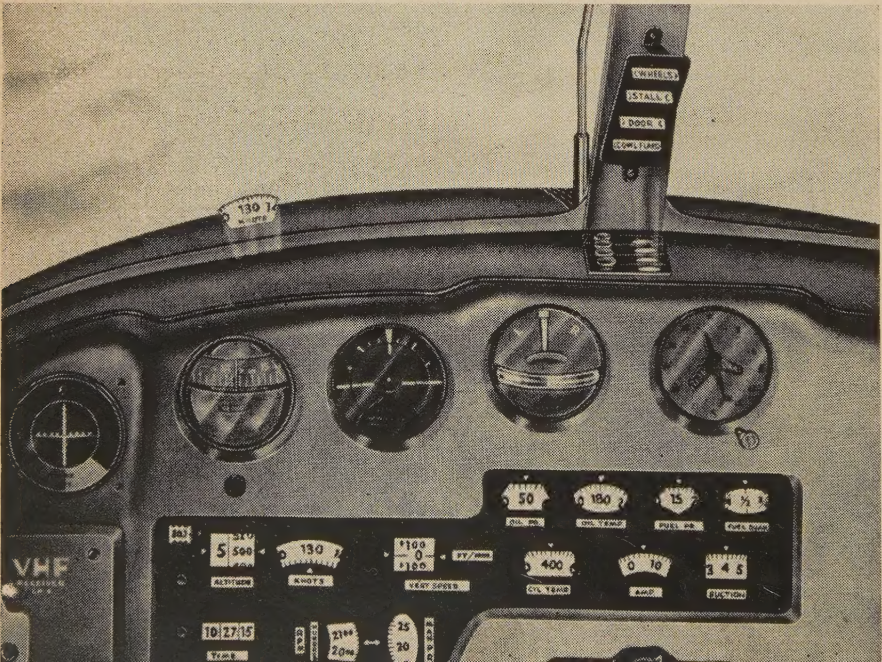
LOCKHEED F-94C *is powered by Pratt & Whitney J48-P-5 engine with afterburner. It maneuvers sharply. Crew consists of pilot and radar operator who guides pilot and plane to target*



COCKPIT *shows unique lighting-method used in Naval aircraft to promote maximum visual efficiency. Individual shield floodlighting units are provided for each instrument*



NIGHT VIEW *of same experimental cockpit shows light confined to the area where it is required, thus providing adequate visibility of instruments, side panels*



CONDENSED *indicating-warning system, developed by Glowmeter Corp., projects portion of original dial to translucent panel. Display area can be reduced 90%*

Instrument Panel Lighting

Authorities claim there is no practical solution to panel-light problem, but engineers are busy narrowing down the possibilities

by Eliot Tozer

When Harry A. Cramer, chairman of the Aircraft Lighting Committee, I.E.S., was asked about a practical solution to the instrument-panel lighting problem, he said, "There is no practical solution."

Flatly and definitely—there's no solution.

And all attempts to find one have mushroomed, thus far, into greater problems. For example, Grimes Mfg. Co. has been trying to resolve the difficulty by building lightweight individual lighting "masks" for each instrument. Says Lewis B. Moore, Chief Lighting Engineer, "We figured we'd need to design 12 or 15 different fixtures to take care of all types of instruments. But we're already turning out 85!"

In fact, the problem is so complicated that Grimes has had to ask customers to send cockpit drawings so that they could design custom panel lighting layouts. "And already," continues Moore, "we're working on an entirely new set of fixtures with major modifications."

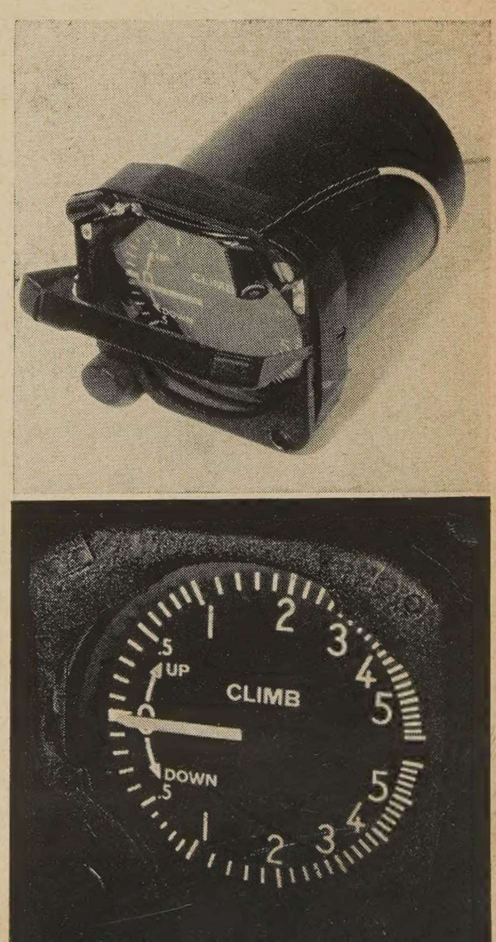
So it's a tangled problem. But Cramer and others are not pessimistic. Illumination engineers may some day come up with a satisfactory solution, but it's a long way off. And all equipment in aircraft today is merely "interim" equipment.

There are reasons why it is so hard to light a panel satisfactorily. First of all, because today's aircraft have so much automatic equipment, instrument panels are glutted with dials. As machines perform more tasks, they become more complex and the measurement of their performance must be relayed to the human operator with more dials and pointers.

Unfortunately, because any cockpit console is limited in size, added dials have been made smaller so they'll fit in. As a result, even in daylight operation it's tough for a pilot to see, evaluate, and respond to the dozens of indicators that confront him.

At night, of course, it's even tougher for the pilot. But still not as tough as it has been for the lighting engineer in his attempt to give the pilot the best panel light. The engineer's problem resolves into two elements *(Continued on page 54)*

NAVY *suggestion is the individual instrument with lighting fixture in closed position. Lighting is confined to face of dial (bottom). Lighting fixture is attached to instrument (below). Clamp holds filter*



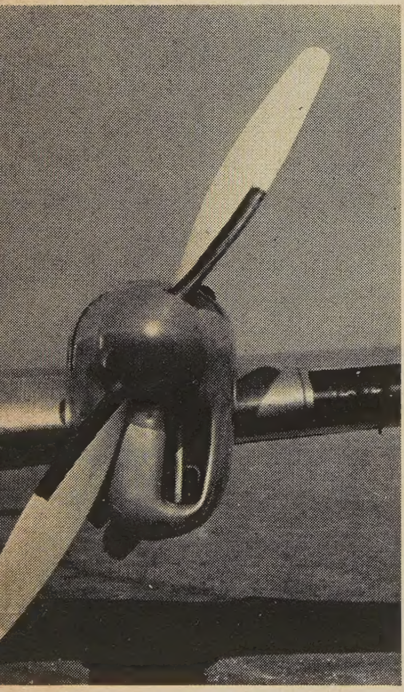
Design/Engineering Report

de Havilland HERON

Four-engined transport, minus cabin appointments, radio gear, offered Corporate market

by William Green

PROPELLERS *on Heron are constant-speed, non-feathering. Extra weight of four feathering props would be equivalent to that of a passenger*



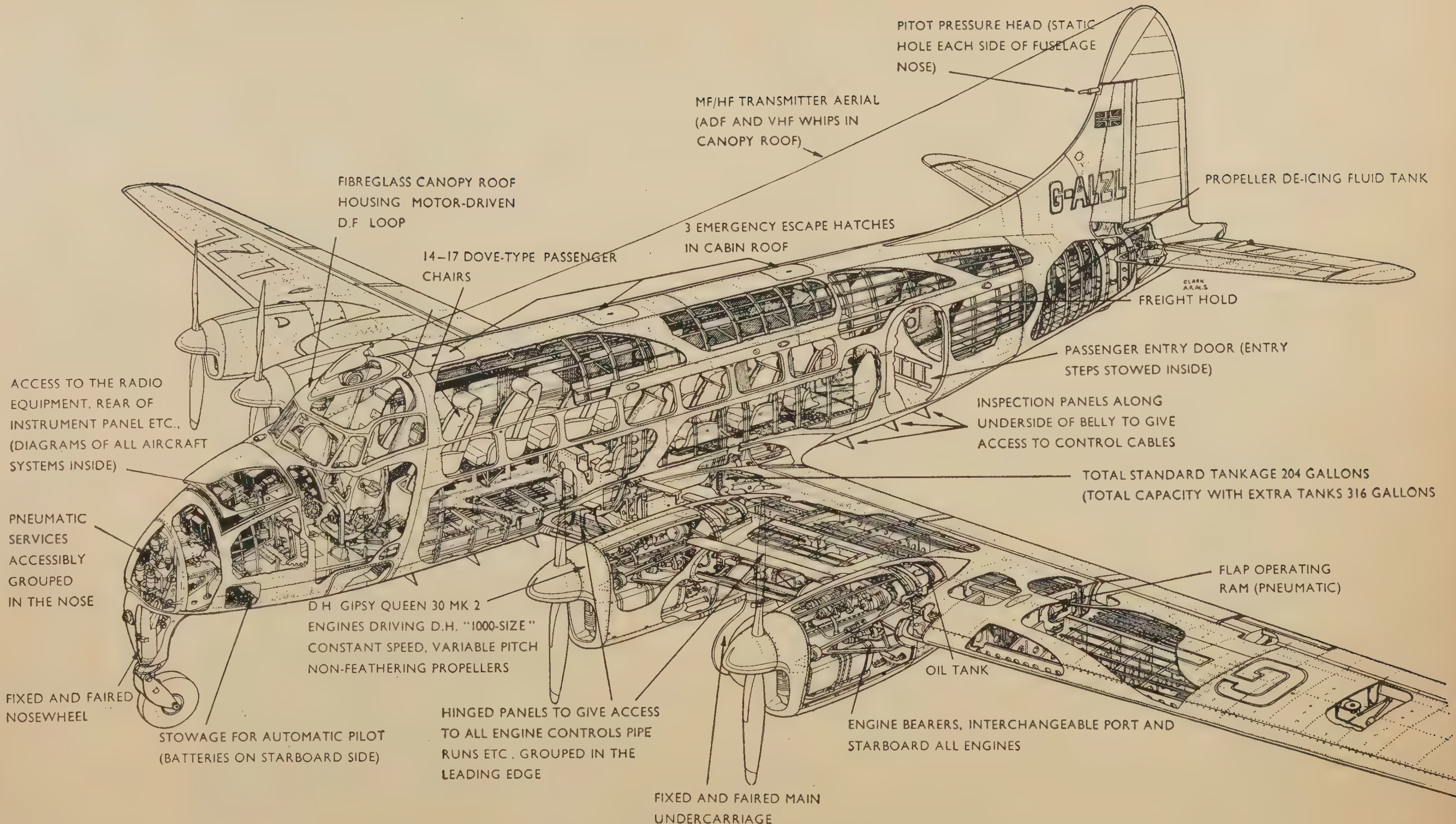
It is an indisputable fact that commercial airplanes are becoming increasingly complex. Today's airliner, with its innumerable devices for maintaining its over-all commercial efficiency, imposes on the operator the need for elaborate maintenance facilities and a very high degree of engineering skill. Indeed, there is some justification for the fear that, if today's trends continue, the small increase in performance obtained by over-complication will eventually lead to a disproportionate increase in maintenance costs, if not a higher rate of unserviceability and a lowering of safety standards.

The executive pilot, called upon to fly in some pretty dirty weather and into unfamiliar airfields which are frequently small and poorly equipped, requires an airplane featuring good take-off, landing and instrument and handling characteristics. The engines powering his aircraft should be able to use the lower grades of aviation fuel, and not be limited to 100 octane, etc. Everything should be simple and get-at-able; engines, controls, etc., should be accessible without the use of special equipment, *i.e.* steps or ladders, for servicing may sometimes be done by the copilot or even the pilot if away from home base. Added to these desirable features should be adequate pilot comfort and cabin capacity, good performance and economy. An airplane offering these advantages will be a strong contender for a slice of the business-aircraft market.

With these thoughts in mind, it was refreshing to examine Britain's 14-seater junior-sized airliner, the de Havilland *Heron*, in which the design keynote of simplicity has been taken so far that some might regard the plane as old-fashioned. But the *Heron's* fixed landing gear, ungeared and unsupercharged engines, non-feathering propellers and mechanical linkage of the constant speed units and throttle controls, although contrary to modern practice, are not necessarily retrogressive steps, for this airplane represents the logical compromise between the highest aerodynamic efficiency with its attendant complications and costs on the one hand, and the extremes of simplicity which *(Continued on page 17)*

DE HAVILLAND HERON *is, in effect and appearance, a four-engine Dove. Many Dove components have been used in construction of Heron. Queen 30 engines that power Heron are same as 70's but without supercharger, reduction gear. Executive-plane operators can purchase Heron without interior appointments and without radio equipment. Tentative price for Heron is $150,000 fly-away distributor's base*

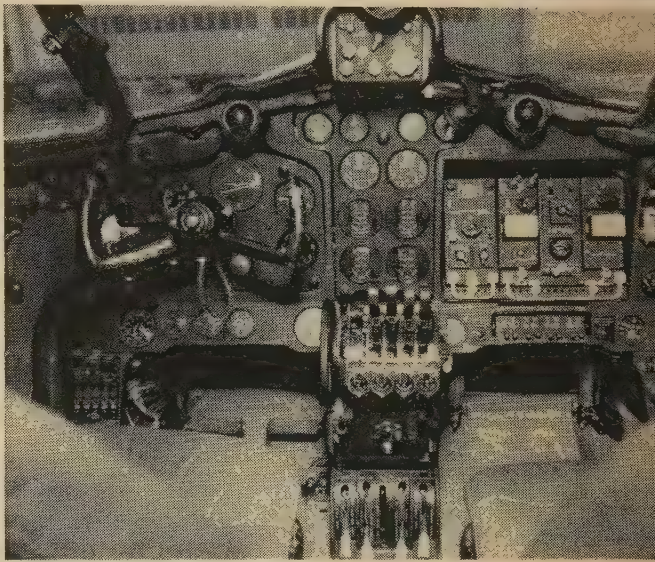
THE HERON IN DETAIL



CUT-AWAY DRAWING *of Heron shows seating arrangement of the airliner version. Bulkheads can be removed for cabin layout alteration*

ADF HOUSING *atop Heron's canopy (top, right) also supports the Heron's fixed aerial. This housing is referred to by British as "fireman's helmet"*

COCKPIT LAYOUT *of Heron (below, right) is similar to Dove's in main essentials. Blind-flying panel and flight instruments are on the left-hand side*



demand a penalty in speed and payload on the other.

For the executive owner rating speed above operating economy, a *Heron* with fully retractable landing gear is presently in its initial test stage, but will be available for delivery very shortly.

Economy and Four-engine Safety . . . .

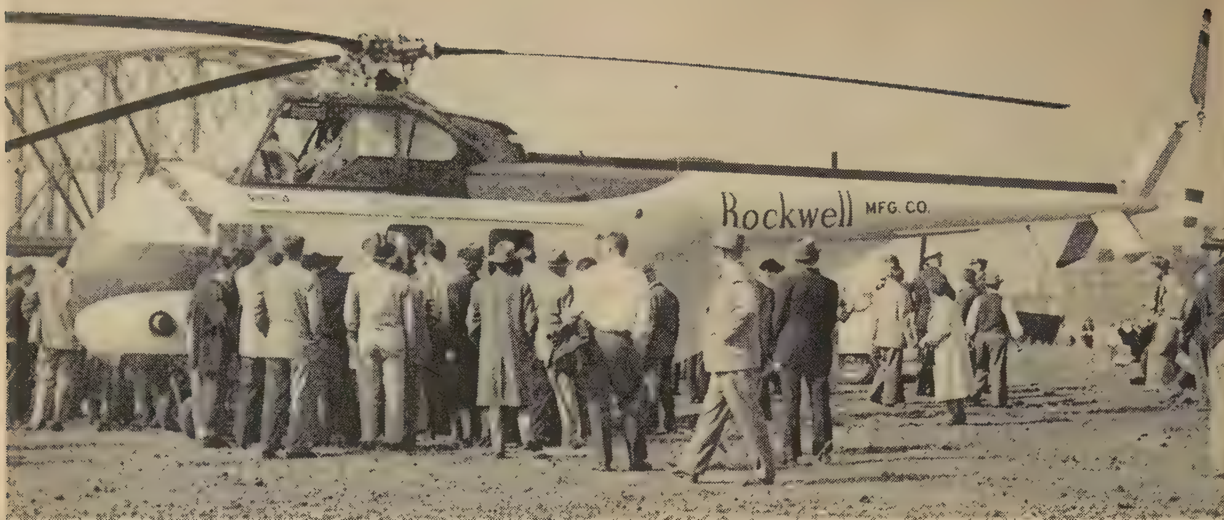
Soon after the end of the war, the de Havilland company introduced its *Dove*, already popular in the United States and analyzed in a recent issue of *SKYWAYS.* At the time when the *Dove* was first considered, the manufacturers realized that they would ultimately have to build an airplane for use where the *Dove* offered inadequate capacity. But this project was given second place to the *Dove*, and it was not until 1950 that the larger airplane, the *Heron*, made its debut.

The *Heron* is, in effect and appearance, a "blown-up" four-engined *Dove,* and a great many *Dove* components have been used in the construction of the larger airplane, ensuring for the *Heron* the reliability of a proven airframe and enabling the type to be readily absorbed into an established production line. By using the same wing outboard of the engines, main fuselage and tail units, control surfaces and various internals as the *Dove*, the *Heron* can be built largely from existing tooling, reducing the cost of both airplane and spares.

A tentative price of $150,000 (fly-away U.S. distributor's base) has been mentioned for the standard *Heron* with fixed landing gear, and the plane's unique take-off and land- *(Continued on page 50)*

MAINTENANCE *is made easy on Heron by profusion of hinged cowlings (above, right) which give access to engines, pneumatic valve gear, etc.*

MECHANICS *can work on Heron's engines (right) without having to stand on ladder. Engines are 250-bhp direct-drive, unsupercharged Queen 30's*



ROCKWELL MFG. CO., *of Pittsburgh, recently purchased a Sikorsky S-55 (above) for short-haul operations out of its Pittsburgh factory to its DuBois factory*

BELL 'COPTER *is one of fleet used to haul food and fuel to construction camp located in mountains where transmission line linking two vital points is under construction*

UNITED AIRCRAFT *employs a helicopter as transport for cargo and personnel traveling between its plants located in Bridgeport and Hartford, Connecticut, and airports*

by Jean H. DuBuque
Executive Director, CAOA

The Helicopter for Corporate Use

There is an old adage that says there is nothing new under the sun. Many outstanding inventions of today were dimly conceived in centuries past when civilization was struggling to rise above the limitations of time and distance. Although daring and revolutionary ideas were born in the minds of the ancient seers, the means of material accomplishment generally were not at hand. In light of this reasoning, it is apparent that at a given time and place in the progressive stages of human advancement, when concept and accomplishment coincide, a new and revolutionary invention appears upon the world scene which well may influence the course of present and future history. Such an epochal event took place in the United States in 1939 when that intrepid pioneer of rotary wing flight, Igor Sikorsky, flew one of the first successful helicopters.

As in the case of every revolutionary invention, the "whirligig," as it was dubbed by many of the fixed-wing airplane advocates, was consigned to a dubious future. It was too small, too noisy, too slow, too expensive, and too unstable. It was the consensus of those "in the know" that the public would never accept such an unorthodox air machine as a means of mass transportation.

In the years that followed, the helicopter was considered a novelty. It was only through the untiring effort of a small group of men who believed in the usefulness and versatility of the machine that cast the helicopter in its present unique and daring role. Month after month, the earnest proponents of the "flying windmill" pounded on military doors, trying to sell the obvious advantages of its unusual flight

DROP SIGNAL *is given to pilot coming in with load of lumber for construction of mountain camp. The helicopter is an S-55, one of several used on this project*

HILLER 360 *was designed, built specifically for business personnel transportation a year or so ago. Its wide cockpit accommodates three people abreast*

principles. But on the surface it looked as though the helicopter was doomed to a slow death by strangulation. The national defense "wheels" couldn't or wouldn't recognize, during the hectic reconversion period following World War II, the intrinsic capabilities of the "twirly bird." Military budgets were being cut to the bone by a war-weary Congress. Great numbers of ATC and NATS transport and cargo aircraft were ending up on the junk heap. Others were being sold at ridiculous prices to civilian and ex-service pilots who were hopefully launching into the non-scheduled air cargo business.

In the troubled course of national and international events that followed, the helicopter was almost forgotten in the rush to develop bigger, faster, and costlier fixed-wing aircraft for military and civil use.

Then came Korea. The too few helicopters in the hands of the military forces were rushed across the Pacific with many misgivings to be employed in any way that helicopters could be employed. It was quickly and surprisingly discovered that they were an invaluable aid in rescue and evacuation of the wounded and that tactical and logistical problems could be swiftly solved with their use. The epic feats being performed by these unique air vehicles belatedly rewards the vision and endurance of their pioneer builders.

How quickly the picture had changed. The armed forces now were trodding a direct and widening path to the helicopter industry. Orders flooded their open gates. Business boomed. Plants expanded. New production lines sprang up almost overnight. So swift was the transition from experimental models to quantity production that these late comers in aircraft manufacturing have nearly caught up with the fixed-wing veterans in importance and production methods. The sudden scramble of the military for helicopters helped to revitalize a young industry from an almost starving existence to a solid and rapidly growing segment of the nation's aircraft business.

While acclaim is still being showered on the "little monsters", as they are sometimes affectionately called in Korea, manufacturers of these radically different rotorcraft have dusted off long-shelved plans and are carefully eyeing the commercial and industrial market, particularly the short-haul field.

The helicopter has suddenly become a harbinger of a remarkable new form of civil air transportation. Swiftly and aggressively it has pushed into the world aviation picture as the logical means of closing one open link in man's conquest of the air.

Recently, in a speech delivered in Geneva, Switzerland, before the Eighth Annual General Meeting of the International Air Transport Association, Sir William Hildred, made a most significant statement in this connection:

"The helicopter may be hovering just over the horizon as the instrument of a new field of exploitation for the industry. If it does develop to the stage where it becomes a commercial proposition for carrying traffic in volume, even over stages of only a very few hundred miles, it is surely destined to divert far more people from surface transport to the air than the jet plane, the atomic plane, or any other kind of plane that needs several square miles of airport to get into the air."

It quickly may be deduced from Sir Hildred's analysis of the helicopter potential that the ever-increasing size of conventional air transports, the advent of jet air transports, and greatly expanded air travel have resulted *(Continued on page 44)*

by George W. Hoover
Lieut. Commander, USN

Let's Analyze *Before* We Standardize

Failure to standardize indicates available instruments are not satisfactory

"Before we decide what to do, let's find out where we are and where we want to go"—A. Lincoln

In the above case Lincoln was talking about the State of the Union, but the same statement applies very appropriately to the state of aircraft instrumentation. Before we standardize, let's look at what we have and determine whether or not we are going in the right direction.

As to what we have, it is apparent that it isn't satisfactory or we wouldn't continue to hear the cry for cockpit simplification and standardization. The fact that we haven't been able to standardize generally, indicates that there must be something wrong with the method. It follows then that where we are going should be carefully reviewed to determine exactly what is wrong with our approach. With all due respect to the members of our standardization committees and panels, it appears from past results that unless we change our technique, standardization will continue to be an elusive dream.

Before a scientist tackles a problem of research, he usually makes a very thorough analysis to determine what areas his problem covers and what parameters he must deal with. Some will say that in attempting to standardize we have followed this same technique. But this is not really the case. We have spent a great deal of time analyzing the faults of present equipment to determine how to arrange it and how to make room for more, but we have spent very little time in determining whether or not this equipment is adequate and whether or not it was properly designed in the first place.

There have been a great many psycho-physiological studies conducted within the past few years in connection with the man-machine problem but, with few exceptions, the major portion has been studies of a specific instrument or control, and as a rule they have been comparison studies to determine the relative merits of one item as opposed to another. Studies have been made to determine the size and color of numbers on specific instruments with little thought to whether the numbers themselves were actually necessary. This is not meant to indicate that no good work has been done in this field. Human engineers working with the industry have contributed a great deal to simplification and standardization of cockpits. These studies, however, have not been broad enough because they were brought about by immediate problems calling for immediate answers to specific fields. The relatively few psychologists in aviation have not had time to look at the over-all problem. The human engineers must also look to where they are and where they are going.

One of the real hindrances to standardization is the emphasis placed on personal opinion. Because a pilot has flown several thousand hours, and an engineer has worked on instrument development for 10 years, does not in itself make them qualified to determine the *type of indication* needed on the instrument panel. The pilot can very definitely tell us what he needs in the way of information, but he can only compare one indication with another when asked what instrument he *(Continued on page 56)*

Radar Air Traffic Control

Discussion indicates today's radar traffic control satisfactory, but more positive aircraft identification, possibly altitude indication are needed

PRE-ROUND TABLE *get-together found S. A. Meacham of Bendix Radio (left) and Roger Sullivan, Chief Airport Traffic Controller at N.Y. International Airport, sharing opinions on improvements in radar*

David S. Little *(Ass't. to Dir., Flight, American Airlines):* "Before we get into our discussion, I'd like to express the appreciation of all of us for the opportunity of participating in this Round Table on radar. I'm sure the subject will be of interest to many. When it was first suggested, I immediately asked, 'What radar?' I hope all of you agree with me that the subject of radar is too long and wide to be covered properly in one meeting. With that in mind, we decided to confine this meeting to Radar Traffic Control, with airborne and other forms of radar to be taken up at a later date.

"I see our West Coast friends are worried already. They don't have radar traffic control out there. No weather, you know.

"To begin, I'd like to ask a question:—Just what is radar air traffic control? Capt. Gill, perhaps you will answer our first one."

Capt. John F. Gill *(Chief Pilot, Eastern Air Lines):* "As we've known it in the past, air traffic control has been an airspace separation by altitude

"TERMINAL RADAR CONTROL, *both inbound and outbound, at Chicago during months of August, September and October reduced the terminal area delay time to almost zero," Moderator Dave Little explained to Roger Sullivan (left to right), Capt. John Gill of Eastern Air Lines, George Church and Douglas M. Heller, both of Bendix Radio, and S. A. Meacham. Mr. Church and Mr. Heller attended meeting as observers, not participants*

SKYWAYS FLIGHT OPERATIONS ROUND TABLE

APRIL, 1953

Wings Club, New York, N. Y.

and distance. Aircraft improved in performance and size during World War II, but when the war was over, we still had the same old time-separation traffic control system that we'd used in the past. There were no improvements at all.

"A lot of thought was given to various types of traffic control (automatic methods, private-line communication, etc.), but due to the military requirement, it seemed a logical and natural evolution that we go to radar. With radar there would be better utilization of the airspace and, instead of having 30- to 50-mile separation, they could operate into an airport with a separation on the order of 3 miles. Instead of time-separation, we went to an actual observed distance-separation, mainly due to the necessity of handling more aircraft within a given airspace.

"That's about as simple an explanation of radar traffic control as I can give: to better utilize the airspace with no loss of safety."

Dave Little: "*Summarizing a little, the natural characteristics of radar have been employed as a tool to permit the traffic controller to reduce what has been a 3-minute minimum separation of aircraft to a 3-mile separation in the controlled airspace at the terminal area.*

"*Roger Sullivan, would you take our next question:—just what are the basic principles of radar traffic control? Just how is this 'rubber band' operation achieved? How is the 10-minute separation of enroute airway operation reduced to 3-mile separation for final approach in the terminal area?*"

Roger M. Sullivan *(Chief Airport Traffic Controller, N. Y. International Airport, CAA):* "I can speak from a terminal point of view. We at Idlewild implemented the radar inbound procedures last November 15. Prior to this we used time, in lieu of distance, as a factor in which to set up the interval between successive approaches. Since November, we have set up our controls based on taking the relative position of aircraft into consideration as a means of starting aircraft inbound toward the airport.

"**CIVIL AIR REGULATIONS** *are not stringent enough to regulate movement of air traffic during VFR conditions in New York area,*" *Roger Sullivan (left) stated. Mr. Sullivan went on to say that he doubted an adequate means of identification would solve mid-air collision situation in VFR*

"**PLAIN** *polarization is used in most present-day radars,*" *explained J. T. McLamore,* "*but circular is considered answer to seeing through precipitation*"

"As an example, we use Scotland as a primary holding fix. The aircraft hold in a 2-minute pattern. The controllers clear the first aircraft for an approach, and as soon as he reports over Scotland inbound and is positively identified, the controllers immediately call the second aircraft, providing he has not been previously identified, and they have the aircraft report northeast-bound over Scotland. Now, when the second aircraft reports over Scotland and is positively identified, the second aircraft is given a clearance dependant upon the separation that exists between the first aircraft and the second.

"This has cut down substantially the length of time or the interval between successive approaches."

Dave Little: *"Am I correct, Roger, in stating that your utilization of radar at Idlewild at the present time pertains only to the final approach aspect?"*

Roger M. Sullivan: *"Yes, that's right, Dave."*

Capt. Scott Flower *(Ass't Chief Pilot, Technical, Pan American World Airways):* "What effect do the different types of airplanes have upon your control problem, as far as their speed range on the final approach is concerned?"

Roger M. Sullivan: "That does pose somewhat of a problem, Capt. Flower, although I think you have to consider the distance from your holding fix to the airport itself. In this case, it is 15 miles.

"Normally, I think our controllers started with a so-called arbitrary distance—namely, 6 miles. Assume we have a DC-3 checked over Scotland on the hour inbound; then we have a *Constellation*-type aircraft checked over there 6 miles later (we're now speaking strictly of distance rather than time), you'd have to have a tremendous variation of speed to have the second aircraft actually eat up the 3-mile difference from Scotland to the airport itself. We arrive at a so-called arbitrary distance where you take the different types of aircraft into consideration, but even though they leave Scotland 6 miles apart, we have some assurance of arrival at the end of the runway at a minimum of 3 miles apart."

Dave Little: *"That's a very important point. Is there someone at the table who would care to elaborate on the principles of full inbound radar traffic control, such as has been employed at Washington, D. C. for some time, and recently has been inaugurated at Cleveland, Chicago and Minneapolis?"*

Roger M. Sullivan: "I'd like to, Dave. I'm primarily a terminal radar man."

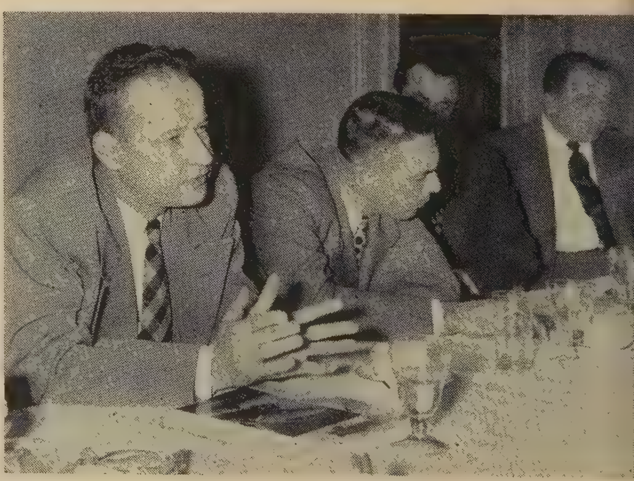
Dave Little: *"What's the difference between what you are doing and what's going on at Washington?"*

Roger M. Sullivan: "I think the essential difference in our particular case is that we have so-called built-in limitations. We take aircraft as they arrive over Scotland and we feed them into the airport as fast as they can give them to us. On several occasions we'll have five aircraft at Scotland. Using radar we can get rid of those aircraft in a relatively short period of time. So, we empty the stack of the five planes, and then we can sit back, smoke a cigarette and read a couple of articles in SKYWAYS because it will take Air Route a certain period of time to again fill the stack.

"For example, in working this traffic we normally keep it on a 20-mile range which affords us coverage out at Scotland. Of course, at times the boys will off-center the scope and shoot out 60 miles. What happens? You'll see a target here, and another target 20 miles away, etc. In other words, after aircraft leave the limits of terminal radar, air route traffic control necessarily imposes the normal ANC separation which has natural limitations in sequencing aircraft in the holding fix. At Washington, they reach out a little further and they can grab the aircraft off the airways and feed these aircraft into the final approach course without any so-called lulls or interruptions caused by the transition from normal ANC without use of radar as opposed to the use of radar. Instead of having aircraft approaching the terminal holding point 20 miles apart, they take advantage of this radar equipment to tuck them up a little closer and are able to keep that stack for the final approach course filled."

Capt. Scott Flower: "What is one of the limiting factors in this separation of aircraft along the airways? Is it communications? Is it the ability of

"**ALTITUDE** *information would be of help to pilots," explained ALPA's Capt. C. H. Daudt. "If the controller could shift this sector and find out how high a reported aircraft is, it would be a big help"*



the radar operator to keep track of these airplanes . . . or is it identification of the aircraft?

Roger M. Sullivan: "I can only give you my own personal views of the matter. In the case of New York Center, I think you'll find the communications limitations are being somewhat compensated for. In spite of the fact that they have improved their communications set-up over at New York Center, they still are operating in accordance with ANC; in other words, where they provide a block of airspace approximately 60 miles long and 2,000 feet deep which in itself imposes definite limitations of traffic into a terminal area."

Dave Little: *"ANC, or Army-Naval-Civil, traffic separation regulations impose a legal limitation of 10 minutes and 2,000 feet of airspace for enroute traffic. When we're dealing with aircraft of 300 mph, that roughly amounts to blocks of airspace 50 miles long and 2,000 feet thick. Assuming for a moment we have the efficiency of ATC Center direct communications with the aircraft involved, is it conceivable, even in a congested area, that a number of converging routes could keep a single airport stack busy?"*

Roger M. Sullivan: "That's entirely possible, Dave. Speaking of Idlewild in our case, they can keep that stack filled. In so doing, we are confronted with definite limitations with regard to the physical aspects of the airport itself and its location. Aircraft destined for Idlewild from the west or northwest are necessarily confined to high altitudes because they are crossing the path of aircraft destined for Newark and LaGuardia. Because of the limitations imposed by aircraft destined for Newark and LaGuardia, quite frequently we have aircraft arriving at the Scotland holding pattern at altitudes of 7500 feet and up."

Dave Little: *"With the stack below essentially empty?"*

Roger M. Sullivan: "Yes."

Dave Little: *"In other words, we have a real communication problem in traffic control, that of expediting the exchange of clearance information to the aircraft enroute?"*

Roger M. Sullivan: "That's right."

Dave Little: *"Let's table that thought for a moment and go on further into the specific development at Washington wherein this condition was found: that if you had only one stack fed by converging airways, the stack as such practically ceased to exist because of the limitations from ANC airways separation and the limitations of relayed communications. In the case of Washington, Cleveland, Chicago and Minneapolis, and in the further extension of radar traffic control, I believe it has been decided that a minimum of two holding stacks must always be used with radar traffic control so that the desired 3-mile separation on final approach can be maintained, the aircraft being sandwiched in by radar vectoring and alternately, one from one stack, and one from another stack, the 3-mile minimum separation being thus established just a few miles from the end of the runway.*

"It was this use of two or more terminal stacks or final approach departure points that I was hoping to get on the record. *(Continued on page 34)*

"USE OF RADAR," *stated Pan American World Airways' Capt. Scott Flower (hand raised), "ought to extend out to 75 miles or perhaps 100, depending on the speed of the airplane, and particularly so if we are getting into jet-aircraft operations"*

"ADEQUATE *plane identification." suggested Capt. Scott Flower, "might make it unnecessary to have altitude information because the plane can give its altitude if you know what plane you're seeing"*

Coca-Cola Company DC-3

There are probably few places in the world and fewer people to whom the Coca-Cola sign and the "Pause that refreshes" slogan is unfamiliar. Almost as familiar at airports-of-call is the executive DC-3 that is owned and operated by the Coca-Cola Company in the interest of business.

Originally a Navy R4D, the business DC-3 was converted for the Coca-Cola people in November, 1952, by Remmert-Werner. A 14-passenger executive aircraft, the DC-3's cabin was made "extra" roomy by moving the forward bulkhead an additional 6 feet forward, thus allowing plenty of space for the passengers. The cabin features eight reclining seats, four of which also swivel, and two divans. A lavatory, located at the rear of the cabin, is finished in grey tile and is complete with mirror, dressing table, etc. A galley is located directly behind the pilots' cockpit.

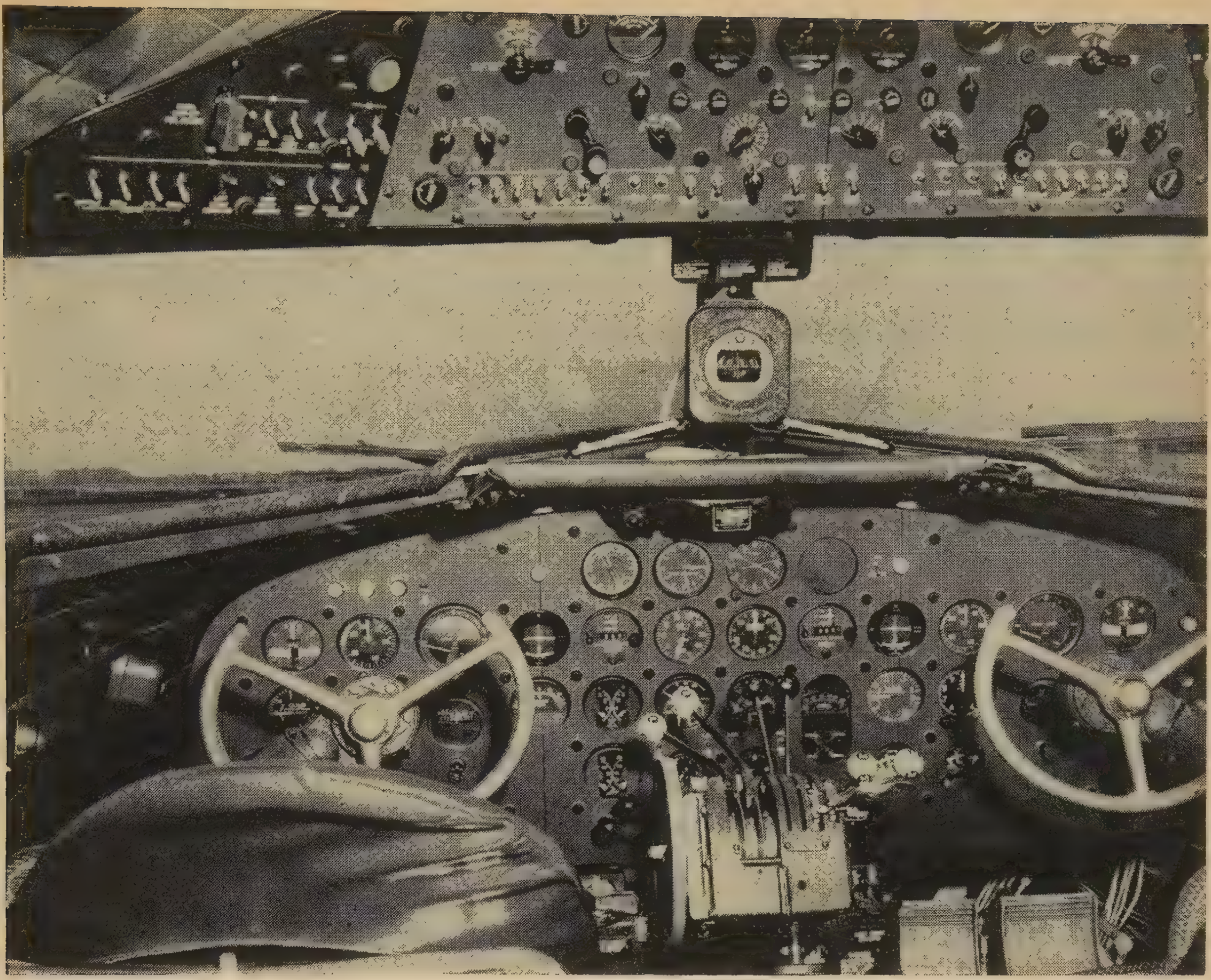
The Coca-Cola DC-3 is equipped with dual omni, ILS, ADF, 20-channel ship-to-shore 18S-4 radio, a marker beacon, a 17L-3 transmitter and 51R receiver, an RMI and an A-12 autopilot, plus a complete Collins set-up. An interesting feature of the cockpit is the two-piece windshield instead of the customary DC-3 four-piece windshield. The aircraft is powered by two Pratt & Whitney R-1830-75 engines which give it a cruising speed of 200 mph.

The Coca-Cola DC-3 is based at Atlanta, Ga.

GALLEY *on board the Coca-Cola DC-3 is located directly behind pilots' cockpit. Note the bulkhead aft of the pilots' compartment has been eliminated*

CABIN *of the executive '3 features two divans and eight chairs, four of which are swivel type. A lavatory, located in the rear of the cabin, is finished in grey tile, features a mirror, dressing table, etc. The conversion work was done by Remmert-Werner, and the aircraft carries 14 passengers*

Photos by Levy-Shipp



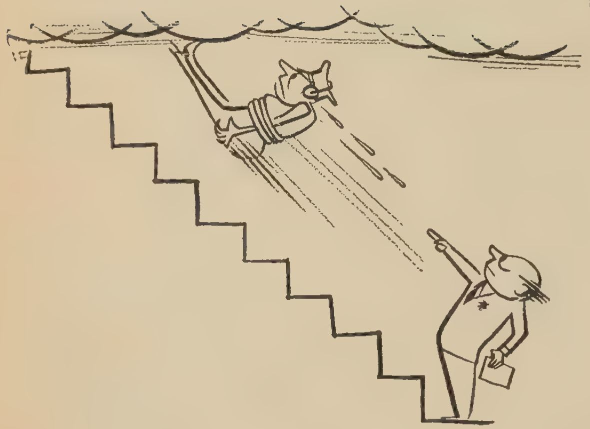
COCA-COLA *DC-3 is powered by two Pratt & Whitney R-1830-75 engines which give the aircraft a reported cruising speed of 200 mph. This executive transport is operated about 50 hours a month and is based at Atlanta, Georgia*

INSTRUMENT PANEL *layout (above) was suggested by Ralph Whitworth, pilot of the Coca-Cola DC-3. It features dual omni, ILS and ADF, marker beacon, etc. Note the two-piece windshield instead of the customary four-piece windshield*

PILOT *of the Coca-Cola DC-3 is Ralph S. Whitworth (left); co-pilot is Dick Young (right). Both men have air transport ratings*

Performance

from the Files of the Flight Safety Foundation



Patterns of Pressure Flying

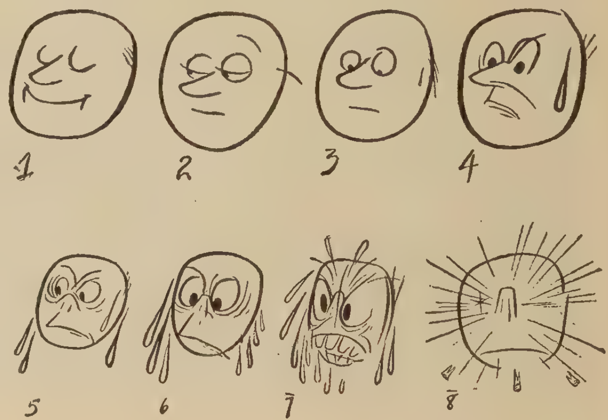
There is more than one kind of pressure, and one of the most dangerous is that of a pilot being pushed into making flights against his better judgment.

While executive-aircraft owners are among the most active supporters of greater safety, there have been occasional cases of "speed above all else," with its accompanying failure to realize that the performance that can be delivered from any operation, business or otherwise, depends directly upon the experience and tools available. If these are limited, then the expected limits of performance must be similarly adjusted.

An executive who felt his business was being hampered by having to stick to airline schedules decided to have his own operation, and so hired a pilot who had a reputation of being very thorough and precise in all his flying. The airplane, however, proved to be unsuitable for the type of weather flying the executive wanted to do, and the pilot so advised his employer. New radio equipment, etc., was ordered immediately, but in the meantime the pilot was being paid a salary to fly, not to sit on the ground and wait while the aircraft was brought up to the proper standards.

Then came the day. An instrument flight plan was filed for a flight over the Rockies. The executive, even though he had no license, was to sit in the righthand seat and act as copilot. In addition there were three passengers. Shortly after take-off a position report was made, but beyond that no known radio contacts were made. The flight did attempt to call a station later on, but without success. A third station heard this attempt and tried to contact the flight, but this met with no success either. In the meantime, the weather became increasingly worse, and most flights in the area cancelled out completely.

At 14,000 feet over Donner Pass, the executive-plane's right engine lost power and stopped. The pilot decided to proceed about 35 miles to make an instrument approach to an airport. Severe icing



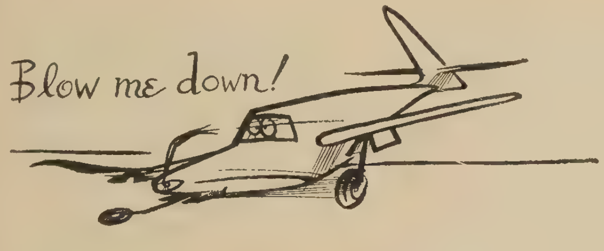
conditions were encountered, and the plane had prop slinger rings but no wing or tail de-icing equipment. After apparently lining up with the runway on final approach, the aircraft veered off to the right, struck a power line, the roof of a house and crashed in an inverted position about 500 feet from the wires, bursting into flames. Miraculously, the executive-owner and the three passengers got out all right (two with minor injuries and two uninjured). The pilot, however, lost his life in the crash.

PITFALLS

by Jerome Lederer and Robert Osborn

It was clearly evident that, in this case, the pilot was operating against his better judgment because he wanted to keep his job. It caught up with him before he got his "suitable" airplane or even the radio equipment he wanted.

Here's still another example of "pressure" flying: With the wind registering 20 mph, gusts up to 40 mph, and blowing 90° across the runway, a lightplane started a take-off on a business flight. As the take-off progressed, the right wing dropped sharply, causing the right wheel and wing tip to strike the runway. The ship was righted, but it veered to the left downwind, heading straight for a jetty. The pilot closed the throttle and, as the plane settled on the runway, the right gear collapsed, the right wing dug in and the nose gear gave way. No injuries were sustained but the damage to the plane was considerable . . . . and the business appointment was not kept.



Flight Check Errors

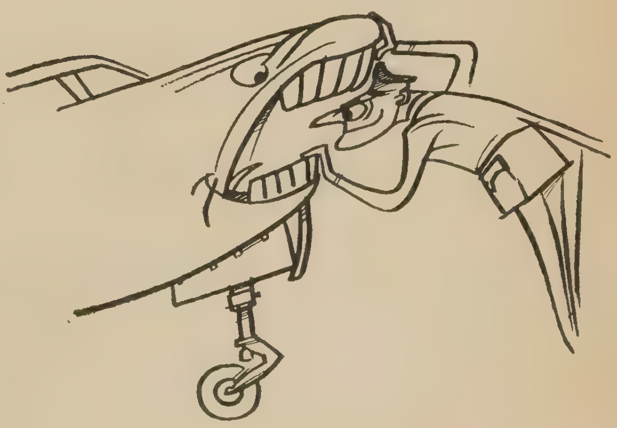
Check pilots list the following errors in manual loop orientation and tracking, as occurring frequently on flight checks:

1. Over-correcting; applying opposite or improper corrections; generally poor bracketing; slow in recognizing or improperly compensating for drift.
2. Obtaining too wide a null; poor turning for null; poor volume controlling.
3. Flying plane improperly while orienting.
4. Slow in working orientation problem; forgetting formula or procedure; poorly estimating time and/or distance to station.
5. Not establishing and holding track; allowing insufficient time to establish track.
6. Using incorrect procedures with manual loop equipment.
7. Improperly manipulating or aligning azimuth.
8. Varying or not holding proper altitude.
9. Misreading or slow in interpreting needle instructions.
10. Making poor mental calculations or errors in arithmetic; using wrong formula.

(Source: National Research Council Committee on Aviation Psychology)

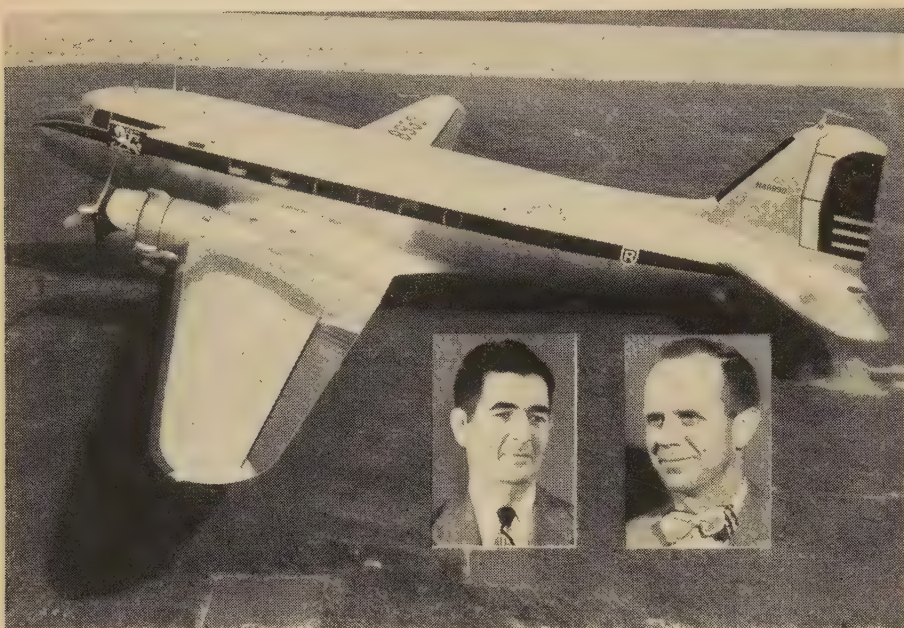
Look Before You Weep

The following incident emphasizes the need for a walk-around inspection before starting a flight. On an acceptance flight check of a multi-engine airplane that was just out of overhaul, the check pilot unintentionally encountered a severe thunderstorm and he was forced to go on instruments . . . . . but without airspeed indication or rate of climb! It was discovered that in the process of re-painting the airplane while in the shop, masking tape had been placed over the static orifices and had never been removed. Having performed no walk-around inspection, this condition was not "caught" prior to flight.



SKYWAYS FOR BUSINESS

NEWS NOTES FOR PILOTS, PLANE OWNERS OPERATING AIRCRAFT IN THE INTEREST OF BUSINESS



REYNOLDS METALS CO. *pilots, Charlie Johnson (left, inset) and Bud Watts (right) have just completed flying Reynolds planes 1,000,000 miles without accident. Reynolds Metals bases DC-3 (above), Navion and Beechcraft at Louisville, Ky.; a second DC-3 is based at Richmond, Va.*

New Runway Lighting System Installed at Reading, Pa. Airport

Reading, Pa. A new runway lighting system recently was placed in service at the Reading Municipal Airport.

The new system covers three runways, 18-36, 13-31, and 5-23. Runway 18-36 is equipped with 57 high-intensity 200-watt lights; Runway 13-21 has 60 medium-intensity 45-watt lights, and Runway 5-23 has 53 medium-intensity 45-watt lights. In addition, the taxiway is equipped with twenty-five 40-watt lights. All lights have fixtures which throw beams in a "V" shape away from the runway. Thus, the necessary illumination is provided but no lights shine directly on the strip.

According to engineers, with the new lighting system it is now possible for aircraft to use the field under extremely adverse conditions. Pilots have reported seeing the lights from as far away as 16 miles.

Engineered by Gilbert Associates and built by Margold Electric Co., the new system cost approximately $131,000. The system is approved by CAA.

Executive Aircraft Mobilization Plan Suggested to Govt

Washington, D. C. A mobilization plan designed to utilize the vast reservoir of DC-3 corporate executive aircraft in the event of a military, civil defense or other national emergency was announced recently. The proposal was suggested in letters addressed to the Secretary of Defense, the Secretary of Commerce and the Federal Civil Defense Administration, by J. B. Lewin, President of North American Aircoach Systems, Inc., with headquarters in Burbank, Cal.

According to Mr. Lewin, no plans have been announced providing for maximum utilization of this reservoir of about 250 aircraft, though elaborate programs have been completed for use of scheduled airline aircraft on a national level and utility-type aircraft on an individual state basis.

"Organization of this voluntary fleet will provide military and civil defense with an aerial minuteman brigade capable of swinging into action instantaneously with a passenger lift capability greater than five World War II Troop Carrier Groups," Mr. Lewin stated. To facilitate activation of his plan, he has volunteered the nationwide (21 cities) communications facilities operated by North American as well as the services of available dispatch and operating personnel.

Geared Rudder Trim Tab Adds to DC-3 Operating Efficiency

Los Angeles, Cal. AiResearch Aviation Service Company has received CAA approval for the installation of a geared rudder trim tab which will increase the safety and operating efficiency of DC-3 aircraft.

According to Eddie Belande, Vice President and Manager of AiResearch Aviation Service, the new trim tab arrangement permits the use of 1350 horsepower on take-off compared to the 1200 horsepower currently permitted with larger engines.

Pedal force on the rudder has been reduced by 50% with the new geared trim tab and rudder travel is limited to 20° of operation, preventing it from reaching the stall zone. This permits full and maximum control of the airplane at all times, including take-off.

Lighter forces and the absence of unusual characteristics not only contribute to safer flying but produce less effort and fatigue, particularly during instrument approaches in bad weather.

This new modification was designed for use in conjunction with a geared trim tab arrangement on the ailerons and the installation of auxiliary fuel tanks, prefabricated for installation in the outer wing panels. The aileron tabs are now undergoing extensive flight tests and the CAA approval for greater gross weight is expected soon.

Mr. Bellande reported that AiResearch Aviation Service Company holds exclusive rights on the engineering and commercial installation of the geared trim tab for both rudder and ailerons. Also, this system is the only one approved thus far for use with an electronic auto pilot.

Beech Aircraft Engineers Get Bonanza for Business Travel

Wichita, Kans. No longer are the engineers at Beech Aircraft like the shoemaker's daugh

ENGINEERS *Ralph Harmon (left) and Marvin De Lapp check map before take-off on Beech trip in the new Bonanza placed at their disposal*

r. At long last the men who are designing d building Beech aircraft have a *Bonanza* their own to enable them to better accomish their necessary out-of-town chores and cut down the amount of time they have to away from their drawing boards.

In addition to using the plane to travel to portant meetings with sub-contractors, and design-development conferences, Beech enneers will use their *Bonanza* on recruiting ps for engineers coming out of our colges and universities.

Ralph Harmon, assistant chief engineer, is charge of details on the new plane.

B. Maytag and Plymouth Oil urchase Business Aircraft

New York, N. Y. Two newly converted busiess aircraft have been sold by American Airaft Corp., Teterboro, N. J. A Lockheed *odestar* powered by two Pratt & Whitney R-320-94 engines was sold to L. B. Maytag of olorado Springs, Colo., and a PV-1 powered two Pratt & Whitney R-2800-31 engines as sold to Plymouth Oil Co., of Senton, Tex.

Conversion work on the *Lodestar* was done Oakland Airmotive Corp., Oakland, Cal. ne PV-1 conversion was done by Howard ero Service of San Antonio, Texas.

an Dusen Blink-R Lights rove Popular with Pilots

Minneapolis, Minn. According to report, ore planes today are equipped with Van usen Blink-R than any other type of navigaon light flashing equipment. The units are w standard equipment on four different pes of Army and Navy aircraft including e Bell, Hiller and Kaman helicopters, the essna L-19 and the de Havilland Beaver. hey are also installed on hundreds of execuve aircraft.

The Blink-R, put out by Van Dusen Airaft Supplies, Inc., with offices in Minneapis, Teterboro, N. J., and East Boston, Mass., eighs 13 ounces and flashes up to 75 cycles er minute with no radio interference. It is ailable in 12- or 24-volt models.

ILMAN *R. Havenstrite (left) and Pilot Red edfern recently returned from globe-circling ip in their C-47. Air tour took in 65 countries*

. . . in the Corporate Hangar

Aerovox Corporation's D18S has just undergone a complete radio installation at Atlantic Aviation's shops at Teterboro, N.J. The system consists of a custom control radio panel with a Bendix ADF MN-53 marker beacon receiver, TA-18 transmitter, a range receiver, a glide path receiver, ARC omni and communications system, and also a radio telephone system. Pilot of the Aerovox Twin Beech is Joseph Cowhig.

Pilot Harold Brasher has the O.C. Harper de Havilland *Dove* back in the air after installation of a Flite-Tronics MB-3 marker beacon receiver. The work was done by West Texas Flying Service at Midland, Texas.

Davison Chemical Co., of Baltimore, Maryland, has taken delivery of its newly converted DC-3. Conversion was done by Remmert-Werner, St. Louis, and included installation of Pratt & Whitney R1830-75 engines, Goodrich (Hayes) brakes, Collins 17L, 51R omni, 51V 20-channel glide slope, and an ARC isolation amplifier. The Davison Chemical DC-3 also features a new one-piece birdproof windshield, lucite instrument and radio panel lighting, and a deluxe executive interior. Chief Pilot for Davison Chemical is Ed McFee.

Wagner Ranch's *Lodestar* has been in the hangar at Pacific Airmotive, Burbank, Cal., for considerable airframe maintenance work and tank seal. Bill Eyster is Wagner Ranch's pilot.

A de Havilland *Dove*, jointly owned by Pennsylvania Optical Co. and Reading Batteries, Inc., is having special instrument and communications equipment installed and relocated by Reading Aviation Service, Inc. The *Dove's* new custom panel will include ARC-1 50-channel transceiver, ARC T-11B auxiliary transmitter, ARC-11 isolation amplifier, ARC-15D omni, MB-3 marker, R-89M six-channel glide path receiver, Bendix MN-62 ADF and a Lear L-2 auto-pilot. Pilots of the *Dove* are Henry Cheatham and J. Turner Moore, presidents of the respective companies.

The Aero *Commander* owned by Pacific Lumber Company and piloted by Barney Evart, has just had a Flite-Tronics MB-3 marker beacon receiver and CA-1 audio distribution amplifier installed. Qualitron, Inc., of Burbank, made the installation.

Rawson Motors, Inc., of Plainfield, N.J., recently purchased a Twin Beech from Atlantic Aviation. Prior to delivery, the airplane was given a 1,000 hour overhaul and two zero-time engines were installed.

A new instrument panel, a complete radio and a new electrical control panel has been installed on the Wrigley Corporation's DC-3 by Pacific Airmotive. Bob Sheker and John DeMuri are pilot and copilot of the Wrigley plane.

General Precision Laboratories, of Pleasantville, N.Y., have had their C-47 at Remmert-Werner for installation of a Sperry A-12 Autopilot and a 100 hour inspection.

Gordon Johnstone, chief pilot for Kerr Manufacturing Co., brought Kerr's Aero *Commander* to Reading Aviation Service, Reading, Pa., for engine maintenance work. Home base for the *Commander* is Detroit.

The Lockheed 12 belonging to Paul Mantz is back in the air after repairs to a damaged fuselage section. The work was done at Pacific Airmotive's Burbank shop.

Heckett Engineering Co. of Butler, Pa., has its *Dove* back in service after radio and engine work at Reading Aviation. Pilots are John Gildea and Al Dorwin.

Bill Russell, chief pilot, and Irvin Redfern, copilot, have the Havenstrite Oil Company's DC-3 at Pacific Airmotive for maintenance work. The plane recently returned to the U.S. after a four months world tour.

CAOA report

CORPORATION AIRCRAFT OWNERS ASSOCIATION, INC.

Corporation Aircraft Owners Association is a non-profit organization designed to promote the aviation interests of the members firms, to protect those interests from discriminating legislation by Federal, State or Municipal agencies, to enable corporation aircraft owners to be represented as a united front in all matters where organized action is necessary to bring about improvements in aircraft equipment and service, and to further the cause of safety and economy of operation. CAOA headquarters are located at 1029 Vermont Ave., N. W. Washington 5, D.C. Phone: National 8-0804.

CAOA Member Wins Michigan Aviation Safety Award

The Packer Pontiac Company of Detroit, an active CAOA member, has been named to receive the 1952 Michigan Aviation Safety Award, according to Robert Crawford, President of Airway Underwriters, Inc. of Ann Arbor, Michigan.

The award is made annually by Airway Underwriters together with the Aero Club of Michigan in recognition of outstanding achievement in the advancement of air safety. Mr. Crawford stated that the 1952 award serves the particular purpose of giving recognition to safety accomplishments in the field of industrial-aid aviation.

Packer Pontiac Company, one of Detroit's largest automobile dealerships, has long been a very successful operator of executive aircraft. The company's spotlessly maintained Grumman *Goose* is a familiar sight at Detroit's busy City Airport. William M. Packer, President of the company, and William M. Packer, Jr. are both active pilots. Mr. Packer, Sr. is one of the motor city's best known and respected aviation enthusiasts, having operated airplanes for over 27 years, with more than 10,000 flying hours without injury to persons or damage to property.

Plans are now under way to present the specially designed award certificate at a forthcoming meeting of the Aero Club of Michigan.

Safety Discussion Meeting Held by St. Louis Area Executive Pilots

The third in a series of all-day discussion meetings conducted by the St. Louis CAA ASDO in conjunction with the St. Louis area executive pilots was held in December at the BOQ of the Lambert Field Naval Air Station, St. Louis, Missouri. The meeting consisted of a panel discussion during the afternoon and a presentation of the subject "Aircraft Icing" during the evening meeting. Plans and organization of this meeting were under the Direction of CAOA Representatives, Ralph Piper, Monsanto Chemical Co. and Lee Dorrance of Gaylord Container Corp., of St. Louis, Missouri.

During the afternoon meeting, a panel consisting of Mr. William E. Clark, Chief Air Carrier Branch of the CAA, Mr. Edwin B. Schaeffer, General Operations Agent, St. Louis ASDO, Mr. Oliver M. Hasek, Chief ARTC, St. Louis, Mr. Marion F. O'Brien, Chief INSAC, St. Louis, Mr. Paul Vinyard, Jr., Chief Lambert Field Tower, St. Louis, Mr. Carl C. Daly, Supervising Electronics Maintenance Technician, St. Louis, Mr. Glen Bowie, Chief Meteorologist U.S. Weather Bureau Airport Station, Lambert Field, St. Louis, Mr. Ralph Piper, Chief Pilot, Monsanto Chemical Company, and moderated by Mr. S. F. McCullough, Supervising Agent, ASDO St. Louis, discussed with the pilots and others present mutual problems concerning aircraft operations as pertaining to the executive pilots. The subjects included among other things: Interim Operating Procedures VHF and L-MF Systems; ARTC Direct Radio Frequency; ADIZ Flight Plans and Interceptions; St. Louis Departure Precedures; Weather Bureau Airport Station's Organization and Objectives; Weather Bureau Forecasting and Briefing Procedures; Traffic Patterns, including noise abatement and complaints; Flight Notification Messages and present and contemplated Electronic Navigational Aids.

At the evening meeting, a comprehensive presentation of the subject "Aircraft Icing" was made by Mr. Howard E. Hall, Assistant Regional Manager of Flying, Trans-World Airlines, Mr. Hall was assisted by Mr. J. Crawley, Director of Training, TWA, and Mr. J. H. Todd, Chief Meteorologist, TWA. Combining the use of a sound movie, slide photographs and talks, those gentlemen illustrated the important aspects of severe icing, the importance of good meteorological data, proper flight planning and proper de-icing and anti-icing procedures.

In addition to the large number of executive pilots attending this meeting, there also were representatives from: Aviation Insurance Companies, CAOA, St. Louis *Post Dispatch* newspaper, CAA Aeronautical Center, Fifth Region Aviation Safety Division and Fifth Region Facilities Division.

Air Navigation Facilities Proposed in 1954 CAA Budget

A total of $13,000,000 for the establishment of air navigation facilities by Civil Aeronautics Administration has been included in the fiscal 1954 budget, recently submitted to Congress. Almost double the $7,450,000 appropriation allowed in fiscal 1953, the $13,000,000 would be used to continue the modernization, repair and relocation of existing facilities of the Common Civil-Military System recommended by the Radio Technical Commission for Aeronautics.

Revision of RTCA's program called for 2,021 installations to be made throughout the country. As of June 30, 1953, 1,028 will be completed, and it is estimated that an additional 267 installations could be accomplished by June 30, 1954. A detailed schedule of the air navigation installations is shown on the chart below.

The budget also requests $4,000,000 for the Air Navigation Development Board. This large increase over the 1953 appropriation of $1,750,000 is requested for administration and for a three-phase program for research and development on airways facilities, to include basic developments, navigation, and traffic control. Major emphasis is to be placed, it is believed, on basic developments and traffic control aids during 1954. The increased appropriation is for comprehensive evaluation of equipment and for resumption of long-term projects which were deferred because of the defense mobilization program.

Facility	Revised Program	Cumulative Installations Under Available Funds 6/30/53	6/30/54	Balance	Proposed in '54 Budget	Bal. to be Financed in Future Years
ILS	168	154	162	6	—	—
App. Lights	168	107	107	23	—	38
DME	638	270	447	—	—	191
Precision App. Radar	57	9	21	—	—	36
Airport Surveillance Radar	83	28	43	7	12	21
Secondary Radar	83					83
DFE	243	20	56	—	12	175
VHF	545	419	433	3	14	95
Mech. Inter-Locks	36	21	26	10	—	—

Aircraft "Buzzed" by Military Pilots

OA National Headquarters recently has ed a number of complaints concerning orce and National Guard aircraft buzz-orporation aircraft. CAOA has entered protests with both the Department of se and the CAA regarding such un-nted flight maneuvers.

Air Defense Commands have assured cooperation in taking corrective action ses of hazardous interception. How-to insure that appropriate action can ken, it is essential that detailed informa-n the time, place and nature of specific ces be immediately reported.

procedure now has been established to e reports of such incidents through any CAA Aviation Safety District Office. A in flight may report interceptions, buzz-or any other hazardous operations by to any control tower, airway traffic ol center, or airway communications n. Such reports are forwarded to the ASDO and through channels to the priate military authority when they in-military aircraft. Reports may also be direct to any Civil Aeronautics Admin-ion Agent or ASDO. Since the time be-the incident and the receipt of the t may be the deciding factor to deter-that the incident was one of normal ception, hazardous operation, or buzzing, of course, important that the report be itted as soon as possible.

is suggested that all executive pilots n information on the normal procedure nterception from the local Air Defense nand. They should then recognize the e of the incident and determine whether hazardous operation before making the t. If reports are submitted on a large ntage of normal interceptions, the in-gating machinery can be bogged down e extent that cases which should re-immediate attention could be delayed initely.

esting Facts About Civil Aviation

e civil aircraft as of January 1, 1952, ported by the CAA............................54,039

Of the civil aircraft listed above, 44,930 are engaged in activities considered to be defense supporting in nature as follows:

Carrier—Airline and large irregular carriers 1,402
cultural—used by farmers and ranchers, and commercially in dusting, spraying, seeding, etc.......12,115
strial—Power and pipeline patrol, survey, etc. 1,687
ess—used in connection with a business or profession—at least 10,000 are corporately owned and operated 19,615
Hire Use—charter for passengers and cargo, air taxi, etc................... 3,576
rnment Use—Federal (excluding military, State and Local................ 1,116
uctional—teaching people to fly.... 5,419

Note: Above figures are an estimate based on a CAA survey made in the Spring of 1951 and adjusted to reflect additions to the fleet since that time, and also attrition due to obsolescence.

The non-carrier fleet is 37 times greater than the carrier fleet. Using the provisions of a "Criteria of Essential Use" prepared as a part of the Report of Task Force "C"—NSRB Air Transport Mobilization Survey, it can be readily determined that the entire fleet of carrier aircraft plus more than 80% of the non-carrier fleet are engaged in activities considered essential.

A survey conducted by CAOA reveals that there are more multi-engine aircraft operated privately, principally for the transportation of executives and other business uses, than are operated by the scheduled airlines of the nation.

A tower count of 1951 aircraft operations at all airports of the USA having CAA control towers, reveals that 84% of the aircraft movements were civil. *(Source:* Study made by Airport Operators Council and based on CAA records.)

Military	16%
Air Carrier	27%
Other Civil (Non-Carrier)	57%
	100%

Civil aviation flew an estimated 11,363,000 hours in 1951. This estimate is based on a CAA survey of non-carrier aviation plus a CAB estimate of hours flown by the carrier and large irregular carrier industry, as follows:

	Hours	*Percent*
Carrier	2,750,000	24.20
Non-Air Carrier:		
Agricultural	1,307,000	11.50
Industrial	403,000	3.55
Instructional	1,902,000	16.73
For Hire	658,000	5.79
Business	2,328,000	20.49
Pleasure or Sport	1,880,000	16.55
Other	135,000	1.19
	11,363,000	100.00%

This same CAA survey of non-carrier flying hours reveals that business and agricultural use of aircraft made substantial gains over a similar survey made in 1949 (no survey in 1950). Whereas the total hours was down from 11 million to 8½ million, the losses were all accounted for by a reduction in instructional flying due to the decline of G. I. Flight training, 4,187,000 to 1,902,000, and pleasure or sport 2,869,000 to 1,880,000. Agricultural flying increased 30%, and business flying 21%.

Business, industry, and agriculture, whose well-being has important bearing on the defense economy of our Nation, are finding the use of the scheduled airlines and the operation of private aircraft to be a tool which, once "milled" into their routine business activity, cannot be done without.

The present national emergency has intensified the volume and extent of flying in connection with business, industry, and agriculture, in both carrier and non-carrier type aircraft. Should the emergency intensify, or an actual state of war come about, the need for such use would certainly be further intensified and would become vital in the extreme.

Many Inaugural Visitors Used Executive Aircraft

CAOA member, Butler Aviation at Washington National Airport reported a record number of movements for non-carrier aircraft bringing Inaugural visitors to Washington. It was estimated that 375 aircraft in the corporate and executive category visited the airport from Sunday through Tuesday. The CAA performed an outstanding job in handling such a large influx of executive airplanes with a minimum of delay in arrivals and departures.

New Members of CAOA

Timken Roller Bearing Co., Canton, Ohio
Green Bay Box Co.—The M & G Co., Green Bay, Wisconsin
Northern Natural Gas Co., Omaha, Nebraska
Lassiter Corporation, Charlotte, North Carolina
Harry K. Coffey & Associates, Portland, Oregon
Pacific Airmotive Corp., Burbank, California
Aircraft Investment Corp., Fort Worth, Texas

GRUMMAN WIDGEON *of the Fuller Brush Company is based at Rentchler Field in Hartford, Conn., along with Fuller's other amphibian, a Grumman Mallard. Widgeon is flown 350 hours a year in the interest of business. Pilot is Ed Wormald (right) shown here with Mr. A. C. Fuller*

Skyways Round Table

(Continued from page 25)

You concur with what I've said, don't you, Roger?"

Roger M. Sullivan: "Right, Dave."

Dave Little: *"I believe we've shown, at least in a small way, how the 50-mile block separation on the airway is reduced to a 3-mile separation in the terminal area through utilization of radar as a tool.*

"Now let's get into some of the advantages and disadvantages of the radar itself."

Capt. Scott Flower: "May I ask a question, Dave? Are there any weather limitations insofar as this type of control is concerned?"

Cole H. Morrow *(Chairman of Board, CAOA)*: "I'd like to bring up some of my apprehensions which have been brought about by personal observation, and I think these apprehensions tie in with what Capt. Flower has asked in regard to weather limitations.

"I have observed the radar at Washington in operation during so-called moderate rain, in which the target would alternately vanish and then come back. This was not on final approach but rather on surveillance radar on inbound terminal area control. It seems to me that the radar can be of greatest value when the weather conditions are the poorest. I'm wondering if some of the Bendix men here can give us any good hope that these targets are not going to be lost.

"On the advantage side of the question is the kind of operation that many of the corporation boys are faced with, in which they don't fly the same route and they don't come into the same airport continuously. That's where radar is of tremendous help in seeing to it that they execute the approach that they think they are executing all the time. We aren't concerned about the hundreds that they make that are exactly as anticipated, it's the one that might not be according to plan.

"Another advantage of radar is in the missed approach. Without radar, it's been necessary in many cases to practically stop operations and clear the area, which results in considerable delay. With radar, it's possible to monitor the aircraft that has executed or is executing the missed approach, and still bring other aircraft in at the same time.

"I recall at Washington a military pilot missed an approach to Bolling Field. Ordinarily, this would have resulted in closing National Airport's operations, but due to the fact that National had him on radar all the time, they continued to clear aircraft into the field during the military pilot's three successive passes at Bolling Field. As a matter of fact, traffic control was not in radio contact with the military pilot during any of this time, and without radar they'd have had no way of knowing where he was or what he was doing."

Capt. John Gill: "Dave, I realize time is short and the problem is broad, but I feel there are a few things of utmost importance.

"Number one, we know radar is here. It's the tool we're going to be working with for some time to come. But as I see the picture, it has a deficiency that must be cured. One problem has to do with weather: the target must be observed through weather. We can't have safe separation if it isn't.

"Number two, radar does not give altitude. It gives distance and you observe the hypotenuse of the triangle rather than the base. Also, high-flying aircraft look the same as low-flying aircraft when seen on the scope. So it all finally narrows down to the fact that we must have positive identification.

"I'd like to skip to another subject in connection with radar, for just a moment. After observing radar in operation on the airlift in Germany, I was quite impressed with the way they used the CPS-5, one of the earliest types, to cover a distance of about 90 miles, breaking up that circle in which the radar worked into many controllers. Taking a segment of 60° each for a single controller, we could have six controllers operate in that area. They did have a certain amount of identification on the airlift, so weather was not the problem there that it is in this country. But I have yet to see in this country several controllers working with the one antenna and individual scopes. As I understand it, there's practically no limit to the number of scopes that can be hooked on to one antenna. With that the case, one area can be broken up into small segments where each controller handles the traffic within his segment. To divide the area that way would largely solve our cross-over problem, and I don't believe radar has been used for that purpose as yet.

"As far as identification is concerned, I would like the manufacturer to tell me how far we are from that all-important item of positive identification of the aircraft."

Wa-Hoo

During the hectic pre-Christmas rush, a would-be Capital Air Lines passenger called a harried and harassed ticket agent in Baltimore.

"I'd like some information," he said, "about the low-cost fares on your stagecoaches that fly at night."

At last report, the Capital agent was soothing his ruffled feathers and quoting Aircoach schedules.

Dave Little: *"To summarize a little at this point, Mr. Sullivan mentioned positive identification; Capt. Flower brought up the point of weather; and Capt. Gill mentioned altitude information as a potential limitation of ground radar. Who of you will elaborate on those disadvantages?"*

S. A. Meacham *(Aviation Sales Mgr., Bendix Radio)*: "Taking first things first, Cole Morrow mentioned weather black-out. That does occur with the equipment now in use at Washington. However, the major portion of that can be corrected with equipment bu
according to present-day techniques. They
using older type equipment at Washingt
That black-out situation definitely can
improved or corrected."

Cole Morrow: "One thing that concerns
is the possibility that we may build up pre
dices to radar traffic control, from an oper
ing standpoint, that may hinder its devel
ment. I mean that by virtue of what we
serve from this so-called old equipme
prejudices might be built up that would sl
radar's development.

"You gentlemen who represent the ma
facturers could certainly help a lot if yo
point out how some of these things are bei
corrected through technical improvements."

S. A. Meacham: "The technique of impr
ing the radar performance in sour weat
when it's most needed is quite well known
engineering people, to those who are buyi
the equipment and to the CAA.

"Engineers have discovered that circu
polarization makes radar more usable in s
weather (rain, etc.) The ASR-3 surveillar
radar does not have the accessory in the
tenna system for circular polarization. Tha
a circular polarization signal as opposed
horizontal polarization signal. Your VOR
tenna, for example, is a horizontal polari
tion signal. Your communications anter
uses a vertical. The radar signals are radia
in the same manner, either vertical, horiz
tal or in a circular fashion, to effect a bet
return signal for the receiver to convert i
a picture on the PPI."

Roger M. Sullivan: "I think perhaps w
better pinpoint the expression 'sour weat
by explaining we mean periods of heavy p
cipitation."

S. A. Meacham: "Another item that
mentioned by Capt. Gill was the lack of a
ity on the part of our present-day radar
differentiate between aircraft at different a
tudes. Capt. Gill mentioned the CPS-5 t
was used in the Berlin airlift. In addition
the CPS-5, they also used a height-find
radar system that allowed altitude identifi
tion. I'm not familiar with the height-fin
radar by name, but it's a vertical dish inst
of a horizontal one—TPS-10. RCA built s
and so did GE. So, it is possible to iden
aircraft in height as well as azimuth and
tance.

"You can develop a three-dimensional l
tion, but again, it's not being considered
part of the present CAA surveillance progr
The radar gear they are purchasing is pu
for two-dimensional information."

Capt. Charles H. Daudt *(Air Line Pi
Assn.)*: "Could the height information
available continuously on a 360° basis,
would it have to be narrowed down?"

S. A. Meacham: "It could be made availa
on a 360° basis and possibly presented
the ASR-3 surveillance radar informat
either on a separate scope, on a separate
or the same PPI, but it does complicate
equipment. In effect, it's two radar syste
Actually, we're doing that now . . . deve
ing three-dimensional information for
precision approach for GCA."

Scott Flower: "Doesn't that bring us point of whether, if we have adequate cation of the airplane, it may be un-ry to have the altitude information? plane can always give you its altitude ation if you know what airplane you're to or seeing."

Meacham: "That may be the reason afety beacons or radar beacons for cation purposes are under develop-here are radar beacons being designed lement the signal. It's quite feasible to em to derive a very positive identifi-"

John Gill: "So far I haven't seen thought was coming in radar. If we radius of 50 miles, we have a diameter miles—that would be the area covered radar and the chief controller. Any infringing upon that circumference be immediately identified. Once iden-he can give his altitude. Therefore, I ee where the altitude is so important, d the target is identified and he can s altitude, *i.e.* that the controller is in nication with the target.

chief controller then could turn the over to a second controller, who is g on the same antenna but observing slice of the 360°. From what I've seen the area is not monitored at the perim-or are targets turned over to approach ler with identity and altitude estab-"

Little: *"I take it, gentlemen, that Flower, Capt. Gill, and possibly Capt. believe that if the azimuth radar is sup-ted by efficient and satisfactory direct nication between pilot and controller, itude radar may not be a required ele-of the ultimate assembly. If I may, I like to hear more on what circular ation is. I think most of us have a idea of vertical and horizontal polari-but what is circular and what is the age of it?"*

McLamore *(Application Engr., RCA):* "Plain polarization, which can be horizontal or vertical, is the system normally used in most present-day A characteristic of horizontal polari-is that you get a great deal of return precipitation. Circular polarization is ally transmitting a rotating vector in-of a plane vector. When energy is re-from a spherical partical (precipita-the direction of rotation is reversed in manner that your receiving antenna pick it up efficiently. As a result, dar effectively sees through precipita-Thus, there are some people who feel ircular polarization is the answer to through precipitation. Using conven-3-cm radar, the attenuation through a is so great that you may not be able a target. It may be necessary to change ncept of what frequencies ground radar use. It is a known fact that the t of energy that is reflected and ab-is a function of the particle size and length. The smaller the particle and

(Continued on page 36)

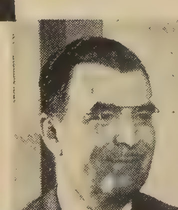
DAVID S. LITTLE grew up with aviation radio development. He has maintained an active ATR since he joined American Airlines in 1939. He flies experimental, test operations for AA.

R. L. DANIEL who participated in the Round Table as a private pilot has been involved in aviation radio since early '30's. He spent several years as Field Engineer in utilization of VHF

ROGER M. SULLIVAN, Chief Airport Traffic Controller at N. Y. International Airport, has been associated with the CAA since 1941. He was part of the Air Corps 1937-40.

S. A. MEACHAM has been instrumental in a number of Bendix developments in field of aircraft communication and navigation radio. He joined the Bendix organization four years ago.

CAPT. C. H. DAUDT is a member of the Air Line Pilots Assn. Central Engineering Committee of American Airlines. He is qualified on DC-2, DC-3, DC-4, DC-6B, C-47, C-87, CV-240, etc.



J. T. McLAMORE has been Application Engineer, Government Marking Section, RCA Victor Division since '35. He has been engaged in design, development of airborne radar equipment.

CAPT. SCOTT FLOWER has been flying Pan Am's international routes for past 16 years. He is presently Asst. Chief Pilot—Technical, for Pan American Airway's entire Atlantic Division.

CAPT. JOHN F. GILL, Eastern Air Lines Chief Pilot, recently won Flight Safety Foundation Award for work on new approach lighting project. His present hobby in aviation is All-Weather flight.

COLE H. MORROW is one of aviation's foremost proponents of the use of aircraft for business. He is Chief Plant Engineer for J. I. Case Co., and Chairman of Board of Directors of the CAOA.

Skyways Round Table

(Continued from page 35)

the longer the wave length the less absorption and the less reflection you get. But on the ground where we can use rather large antennas and still keep the beam width narrow, we can keep sufficient definition for knowing the exact location of the target.

"It is my own personal feeling that we may have to consider going to S band or maybe the so-called C band which is 5.6 cm. You'll get much less effect from weather on either of those two bands."

Dave Little: *"In other words, Mac, you feel that a reduction in the effects of weather on ground radar, as it pertains to ground radar traffic control, may ultimately prove to be a question of not only producing satisfactory circular polarization but also a shift in frequency."*

J. T. McLamore: "Definitely. I can see no point in penalizing ground radar by the high absorption you get at 3.2 cm when, at relatively little more expense, you can go to S band or C band and get everything the 3.2-cm band gives, plus the ability to penetrate weather."

Cole H. Morrow: "In line with what Mr. McLamore has said, I'd like to mention some tests that were run at TDEC in Indianapolis, on the L band which is an even lower frequency. Interference from precipitation was diminished appreciably on the L band. The results have been documented, and anyone interested in reading about it can get the papers from TDEC."

Capt. Charles H. Daudt: "Getting back again to altitude separation, I'd like to question whether or not it would be more practical to take a sector and shift it, instead of having continuously full 360° surveillance, altitudewise? How many degrees is the present horizontal sector that scans precision approaches . . . what's its width in degrees?"

S. A. Meacham: "Actually, it scans a 5° sector."

Capt. Daudt: "What would be the difficulty involved in shifting that sector to some unidentified target out there and finding out how high he is? If, on the presently used horizontal scope, you observed two targets on collision courses, you could instantaneously shift the sector in that direction and tell if they had altitude separation, instead of monitoring 360° continuously for altitude separation. In other words, either or both of the aircraft could be immediately advised in case of an emergency instead of attempting to carry on a conversation with regard to what your altitude is—and especially with Private Joe who is obtaining his Sunday afternoon quota of recreational flying time."

S. A. Meacham: "Yes, you can swing it. The antenna can scan any sector you want . . . any sector of that width; any 5° portion of the full 360° azimuth."

Capt. Daudt: "Many times, when we go out on radar departures, the controllers will tell us there's an approaching aircraft at 1 o'clock. I'll come back and say I don't see him, but I'll keep an eye out for him. Then the controller will come back and say he doesn't know how high he is either. If the controller could shift this sector and find out how high he is, it'd be a big help."

S. A. Meacham: "It would depend a great deal, Capt. Daudt, on how far away the 'pip' is that you're talking about. There is a practical limitation in the accuracy of the system. If you're talking about an aircraft that's 5,000 feet in the air and 50 miles out, it's going to be pretty hard to pinpoint him in altitude at that great a distance."

Capt. Daudt: "Well, that's the question . . . how far out would you estimate it could be done?"

S. A. Meacham: "How accurate do you want the altitude to be? Within a 1,000 feet, you'd probably exceed accuracies at a point roughly 15 or 20 miles out. The errors that exist in a practical system would make it unusable."

Capt. Daudt: "How much vertical error would you have at a distance of 25 miles?"

S. A. Meacham: "You can measure this system almost as accurately as you want to. We build a watch that has tremendous accuracies, and you can build a piece of radar system that has the same control with the same accuracies that you put in a watch. Radar systems today, however, are not that good."

Dave Little: *"Capt. Daudt brought up a point that might not be clear to many readers. I think everyone who has been involved with radar traffic control has sooner or later had the ground controller say, 'I have traffic half a mile ahead at 11 o'clock.' Though it happens on a perfect CAVU day, you look out and see nothing. The question that immediately arises is, 'at what altitude is that traffic?' In the full VFR condition this, of course, is not critical, but to make any system of traffic control efficient the system must function normally 24 hours a day, seven days a week, regardless of weather, so that as the weather changes from CAVU to a borderline condition, which is the most critical condition, the system is already in efficient operation.*

WEATHER *black-out was brought up as a serious radar problem by Cole Morrow (right.)*

"I know from my own point of view tha the most bothersome factor of ground rada control is the ground controller telling me there's traffic at 1 o'clock, 5 o'clock or what-have-you, a half a mile away, when I can't see it and the controller can't tell me at what altitude this traffic is.

"Capt. Daudt's statement was, therefore well put. In my opinion this lack of altitude information is a disadvantage."

S. A. Meacham: "Dave, I've gotten something more official from my consultants here Heller and Church, on this matter of accuracies. They tell me that 500-foot accuracy a 20 miles is practical."

Capt. Daudt: "Dave, I'd like to point ou one thing in connection with what you were saying. The inference might be drawn here that this problem is not critical in VFR weather. I feel that that's when it's the most critical because that is the time when the likelihood of unidentified aircraft in the area is greater."

J. T. McLamore: "I agree with Capt. Daudt. I've never heard of mid-air collisions in instrument conditions; it's always been in perfect CAVU weather."

Capt. Flower: "It's been brought out here that we might eliminate some of this complication in the altitude problem if we had identification beacons on the aircraft. I'd like to ask some of the technical people here i the techniques are known to enable the beacons to be manufactured small enough, light weight enough and at a reasonable price s that all aircraft can carry them. Maybe som of the crux of this problem is proper identi fication of aircraft under radar technique."

Dave Little: *"Let's ask the man who has t handle the dirty end of the work. How abou it, Roger?"*

Roger M. Sullivan: "Getting back to altitud presentation vs. identification, the fact wa mentioned that the most critical times ar during VFR weather. It goes without sayin that, regardless of the type or means of iden tifying aircraft, your regulatory measures i VFR weather are not sufficient. Out on Lon Island, we've had two mid-air collisions be tween military and private aircraft within period of 60 days. Apparently, the regulation are not stringent enough to regulate th movement of air traffic during VFR condi tions. I seriously doubt that an adequat means of identification would help solve tha situation to any extent. Perhaps some mean of presenting altitude would help if the ai craft had filed IFR flight plans and wer under constant surveillance from the groun radar station."

Dave Little: *"In other words, we need change in civil air regulations governing othe than instrument flight operations; we nee airborne radar beacons, possibly circul polarization, a change in frequency, and mu ti-scope presentation. In short, we have se eral problems, gentlemen.*

"Capt. Daudt, will you tell us what the ai line pilot honestly thinks about what he h received in the way of improvement . . . possibly, more hazard . . . from the utilizati

(Continued on page 38)

Skyways Round Table

(Continued from page 36)

of radar traffic control at Washington, Cleveland, Chicago, and elsewhere."

Capt. Daudt: "In the past the Washington area has always been a big bottleneck as far as high density traffic centers are concerned. Radar certainly has been a great help in getting in and out of that place. Radar has decreased getting-in and getting-out time, and I'm certain it will do the same at other airports where it is being installed.

"We also like to use it for departure information with regard to traffic when conditions are between VFR and IFR . . . where they say you have 3 miles, and maybe you have and maybe you haven't. But, as we've mentioned here many times, there are additional needs that should be looked into, such as more positive identification by use of aircraft equipped with beacons and airborne radar. I feel that there are angles to develop with regard to using the safety principle of radar to greater advantage. More effort should be spent in that direction."

Dave Little: *"Thank you, Charlie. Now I'd like to ask Roger Sullivan another question. Isn't it a fact that, in connection with LaGuardia Airport, it was determined some time ago that it was possible to get better runway utilization under night CAVU conditions through the use of radar for establishing and maintaining separation? In other words, isn't a radar-controlled circling and landing pattern better than visual control by pilots and controllers?"*

Roger M. Sullivan: "Definitely. Radar, rather than position reports of aircraft, most definitely gives you the opportunity to better sequence your aircraft, and that gives you better runway or airport acceptance rates than would normally be the case with position reports."

Dave Little: *"I've been very interested in checking the official CAA data on Washington for the months of August, September and October. The use of inbound and outbound terminal radar control according to those records has reduced the terminal area delay time to almost absolute zero.*

"A week ago today I had an opportunity to watch the new Chicago terminal area radar setup working under what is normally a tough condition at Chicago: 500 and ½ with snow. For a little more than two hours the airport traffic controllers maintained, with absolute safety as far as I was concerned, a runway landing rate of 26 an hour. This rate can hardly be approached VFR.

"Mr. Meacham, how about giving us a little more on this positive identification factor, weather, etc.?"

S. A. Meacham: "While we haven't done the work at Bendix, the techniques of designing a safety beacon are well underway. There are one or two technical design problems, but we have every reason to believe these will find solution in the not too distant future. The safety beacon, however, is only going to be partially effective if every airplane in the area isn't equipped."

Dave Little: *"That brings us back to the point Roger Sullivan made: the need for new or changed civil air regulations, making the airborne radar beacon a mandatory piece of equipment."*

Roger M. Sullivan: "That's a challenge to the manufacturer to make this equipment lightweight, inexpensive and reliable."

S. A. Meacham: "That's right, but even where there is lightweight, cheap and reliable equipment, there are many who don't buy the equipment for their aircraft. There are many airplanes flying today that do not have VOR equipment, for example, to utilize Victor Airways, and that equipment can be purchased for any amount you want to pay."

Roger M. Sullivan: "Are the military equipped yet?"

S. A. Meacham: "Very, very limited amount. That's a very good point, and they do have a large number of those sets in their warehouses."

Dave Little: *"There is a point I'd like to explore a little more. It appears that for maximum efficiency vs. normally flown weather, we may want a fairly low frequency radar, possibly with circular polarization. I'd like to ask of the manufacturers and engineers present, isn't there an optimum between frequency and clarity of image on a scope? I'm thinking particularly of a congested area such as New York where you have four Airways, roughly only 12 miles separated and parallel to each other. Isn't there a practical point of how low one can go in frequency and still obtain a sufficiently small blip on the radar scope to give you a usable end result?"*

J. T. McLamore: "That depends on how much complexity in size you want to go to on the antenna. If you want to build large antennas, you can go as low as you want. It's purely a matter of the physical size of the antenna."

S. A. Meacham: "I don't believe definition is the function of frequency. Definition is a function of the video system and the presentation system down on the ground in the control towers."

J. T. McLamore: "Even down to L band, I think range resolution is the only place where you'd suffer. I think even there you could get short enough pulses and wouldn't have to worry about it."

Dave Little: *"What is the limitation in size of a practical antenna?"*

J. T. McLamore: "During the war the military services had some with dimensions of 50 or 60 feet."

Dave Little: *"Is that size practical or impractical?"*

J. T. McLamore: "Well, there were hundreds of them installed throughout the world."

S. A. Meacham: "There is currently a system that has a dish of about a 40-foot beam, and it's a very practical unit."

J. T. McLamore: "The whole thing boils down to a matter of economics."

S. A. Meacham: "Every piece of radio equipment, regardless of what its use may be, is a compromise between techniques, theory and cost."

Capt. Flower: "It then appears that we can have about what we want if we are willing to pay the money for it. So now we have to come to a compromise situation in which we can pay for the system that gives us the most practical compromise."

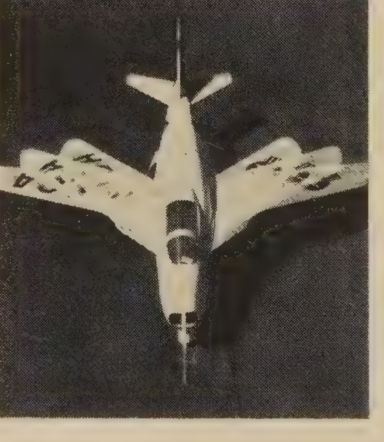
Dave Little: *"I think that's well put. My next question concerns a detail which Capt. Gill touched on, but I don't think he went far enough with it. I think we all agree that through the use of radar and multiple stacks in a terminal area, it is possible to use the available runways at essentially their VFR capacity.*

"Capt. Gill touched on the problem of reaching further out along the airway and feeding the stacks more efficiently. John, what is your thought as to how far that stretch-out should go? Should we completely eliminate air route traffic control as such, and have one radar terminal area hand an aircraft to the next, or is there to be some compromise between the two?"

Capt. Gill: "I believe that eventually it will be handed from one sector to another. At the present time, it's a variable depending upon the density of traffic in the area to be served. If we take the New York area as an example, an area on the order of 50 miles with the Empire State Building as the center, I believe it should be covered in a terminal area control. Any target infringing upon that circumference should be identified and efficiently handled to feed the stacks. The use of radar on final approach from the stack to the runway is very efficient at the present time.

"What you saw at Chicago, Dave, we've seen happen at other places where radar is used in implementing final approaches and is very efficient, but it seems to me that degree

(Continued on page 40)



MULTIPLE-EXPOSURE *photograph shows range through which wings of the research Bell X-5 are moved in flight. Tests are being run at Edwards AFB*

SKYWAYS FLIGHT OPERATIONS ROUND TABLE

Skyways Round Table

(Continued from page 38)

of efficiency falls off rapidly as we leave the vicinity of the airport and the stacks. There's quite an area there for improvement. And another problem that must be solved or improved to a great extent is this one of identification. No one seems to have the answer for it right now. There must be a radar beacon of some kind. In the meantime we must try to make more efficient use further out from the airport of the radar we have. I'd say that'd be about 50 miles in this area, and in another area it might be a 20-mile radius."

Capt. Flower: "Much depends on the speed of the airplane. If we're getting into jet operation, the use of radar ought to extend out to 75 miles or possibly 100."

S. A. Meacham: "At the present time, the New York Center is installing control points for communication purposes well beyond their local equipment—for example, as far out as Williamsport in Pennsylvania, 150 miles away. With radar departure and radar control, they're able to shuttle the airplanes off the end of the runway or bring them back onto the runway much faster than they can control them when they get beyond the communications point, which is an identification problem. They're getting into trouble with that, and for that reason are establishing the transmitter communications point by remote control so they can talk to them. But there they get into a problem with the airlines.

"A company operating between New York and Philadelphia, for example, is unable to communicate with their aircraft flying between two points. The plane will be off the ground at LaGuardia and back on the ground at Philadelphia without ever having an opportunity to change over to company controls."

Capt. Gill: "Let's take a practical case of it: theoretically, using airport radar departure at 3-mile separation to a given point or fix, from that point let's start utilizing multiple altitudes and airways. Theoretically, again, there's far more airway capacity than the radar departure can feed, but in actual practice the reverse is true. They can feed them faster.

"They can give those multiple altitudes and multiple airways at the fix. There's something radically wrong if they can't. The airspace is there; the channels for the occupancy of the aircraft are there, but something is lacking to enable us to get the aircraft into their airway slots when they get to the fix."

Roger M. Sullivan: "I agree, but from recent official sessions on this, you'll find that they have reached the so-called total saturation point in this area. Of course, I think that rests with the ANC deal of a block of airspace 50 by 2,000 feet. It doesn't take a lot of traffic to actually reach that saturation point under those conditions."

Dave Little: *"That's been brought out in the past six months on the New York-Chicago airway where we now know that saturation has been almost reached on the basis of ANC separation.*

"We mentioned economy as possibly being a controlling factor in how much range, how much definition, how much weather we can see through, etc., with radar. There is just so much money you and I as taxpayers can spend. Assuming that our national defense organization now has or procures the desired radars for national defense, I'd like to submit for study the question of using that same radar simultaneously for control of all our traffic and national defense, to save you and me and every other taxpayer from buying another radar when we already may have that radar available.

"The commercial air carriers have long planned on totally separating the air traffic control communication factor from the company dispatch, or the economy communication factor as we call it, and I believe the majority of airline aircraft in the U. S. are so equipped or are well along the road to being so equipped. In other words, the airline aircraft today has two complete and separate communications systems. One solely for air traffic control; the other solely for company dispatch and operational communications. Therefore, the factor of direct CAA ATC communications which was brought up by Mr. Meacham will, I believe, take care of itself as radar control and direct ATC communication further develop. In fact, today CAA is so planning implementation of the New York-Chicago airway that it will soon be perfectly feasible for properly equipped aircraft to be in direct communication with the controlling ATC centers throughout the flight. This should greatly assist the saturation situation on that airway.

"To wind this discussion up, gentlemen, I'd like to ask Cole Morrow and Bob Daniels, my friend now from Hollywood who does a lot of flying, how the corporate and the private pilots take to this idea of expanded radar traffic control."

Cole H. Morrow: "The corporate pilots are interested, enthusiastic and strongly in favor of radar traffic control. We've gone on record to that effect. We've surveyed corporate operators to a large extent, and almost without exception they are very strongly in favor of radar traffic control.

"As I mentioned earlier, we are concerned with this weather problem. We're concerned with the development of the radar safety beacon. We feel that some radar beacon is going to be essential, and the development of the beacon will have to be along the lines that will make it available to the smallest aircraft and lowest cost aircraft. Those are the planes that are going to need it, and so it must be cheap and lightweight.

"We are wondering about en route separation, though, if we discontinue en route traffic control and revert to radar traffic control within, say, 50 miles of the terminal area

(Continued on page 42)

Skyways Round Table

(Continued from page 40)

What can be done about that leads up to the subject of airborne radar which we haven't touched upon.

"In general I think we can say that what has been accomplished so far indicates that radar traffic control is the real answer to our operating needs, and we're very enthusiastic about it and would like to see it progress faster than what it has done so far."

Dave Little: *"Bob, you do a lot of flying around the country. What's your thinking?"*

Robert L. Daniel *(Sales Mgr., West Coast, Bendix Radio)*: "Yes, I do quite a bit of flying, but as a non-professional pilot. We fly in all 48 states and face a lot of bad weather in unfamiliar places, just as do other non-professional pilots who demand real utility from their planes. I'd like to endorse the increased use of radar such as we've talked about here, because of something Mr. Morrow explained earlier. We don't learn the procedures at all of the fields throughout the U. S. the way the fellows who are flying regular routes do. I don't know about Mr. Morrow, but I certainly find myself busy with a lap full of papers and maps. Even though the private pilots make out pretty well, radar certainly would be a good thing to have looking out for us.

"Some mention was made earlier of the weather bureau reporting moderate precipitation while the pilots are actually experiencing heavy precipitation, which is also witnessed by radar attempting to see the aircraft. I think I have an answer for that misunderstanding. It happens in California a lot. They call it "virga." It's raining like the devil a few thousand feet up, but the stuff never hits the ground. It dries up before it gets there. That's the condition that fools many Easterners who think that it rains in California!"

Capt. Flower: "Here's another point that perhaps should be brought up. As you know, we are interested in some very high-speed airplanes coming along shortly. From the studies I've made it appears that radar is the most satisfactory way of handling those airplanes to get them into their final approach. Now these aircraft are limited in the height at which they can hold economically. I believe it's in the neighborhood of 20,000 feet. Here we have a 600-mph airplane coming into the area at 20,000 feet. He can get down very rapidly from that altitude by the use of dive flaps; something on the order of 2,000 or 2500 fpm. He gets down from 20,000 to 2,000 feet where the aircraft is directed onto the ILS facility. What I'd like to know is, have any of you people given any consideration as yet to that type of operation and in handling that type of aircraft?"

Roger M. Sullivan: "We did discuss it to some extent with BOAC. As you recall, they had intended starting an operation in February, using the DeHavilland *Comet* on their New York-to-Nassau run, and all of their problems were presented at that time.

"At a CAA meeting I attended, they indicated they would attempt to provide some additional facilities such as DME and TVOR at Idlewild for the BOAC jet operation whereby they could pinpoint the position of the aircraft terminal area from a point some 50 miles out, where it would almost be a matter of continuous descent right into the airport from 20,000 feet."

Capt. Flower: "Do you feel that you can handle it adequately without penalizing the air operation severely?"

R. M. Sullivan: "I certainly do."

Dave Little: *"I believe the experience at London has indicated the jet can be fitted into the normal operation without the jet being given operational preference."*

Cole H. Morrow: "I watched the traffic simulator out at Indianapolis, and they were simulating the normal traffic at Washington with the *Comet* entered into the traffic picture. I think the procedure, the technique and everything else has been developed to the point where the CAA traffic control people know exactly what to do. Apparently, no difficulty will be experienced. Slightly different approach aids would have to be applied, but that doesn't amount to much."

Dave Little: *"Do any of you have any additional comments you'd like to make before I summarize a bit?"*

J. T. McLamore: "From all that has been said here today and from what I know of radar traffic control in the terminal areas, it appears to me that we do have the means at hand; that radar isn't the bottleneck with handling traffic. As you mentioned, the saturation of the airways is fast becoming fact. To speed up traffic in the future, the problem lies with the present controls we are observing: the 50-mile, 2,000-foot zone.

"From what I can gather here, and from tests that have been run in inter-mixing all types of aircraft, radar traffic control, with the techniques that are available, traffic handling in the terminal area is not the limitation at the present time. The thing that we have done in being able to land airplanes faster is to move the critical point from the end of the runway where it was originally, to the point of departure from the holding point. Now with the use of radar we have moved the critical point out to the 50-mile radius."

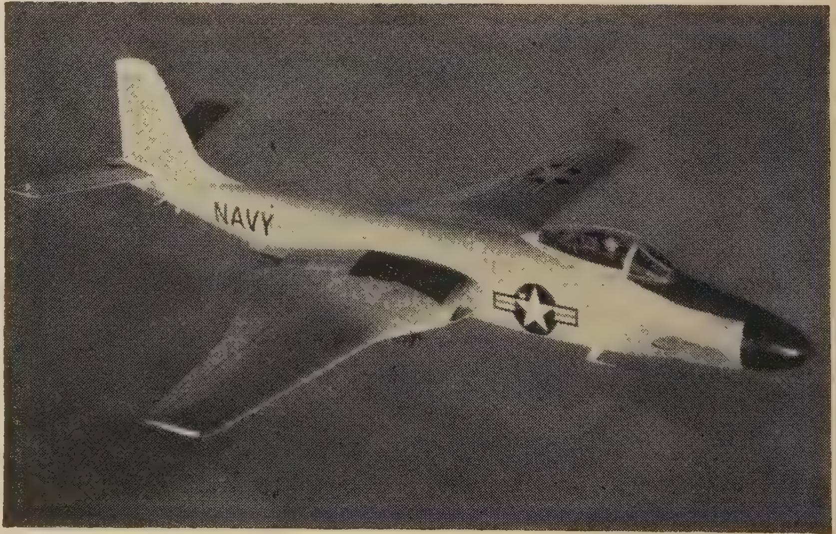
Dave Little: *"Suppose we put in additional terminal radar ATC at Baltimore, at Philadelphia, at New York, at Hartford and at Boston, and designed the several components such as radar, direct ATC communications, etc., to overlap efficiently; then have the Washington Approach controller hand you to the Baltimore controller who, in turn would hand you to Philadelphia, etc. Where then is your bottleneck?"*

J. T. McLamore: "You just push it out until you get complete control."

R. M. Sullivan: "I think we're hitting on the right thing; that is, to expand our radar service from a point of terminal area to a point of about 50 miles, taking into consideration the equipment we have available."

"I think the next step after this so-called expanded radar service would be our individual runway acceptance rate. As an example, at Idlewild it would not be too far in the future that we actually would be concerned about the airport acceptance rate, namely, the configuration of the airport itself imposes definite limitations on the acceptance rate, departure and arriving aircraft."

Dave Little: *"That would be the time, under radar control procedures, that one might make one turn of a holding pattern at a low altitude . . . just to establish the minimum of separation?"*



McDONNELL F2H-3 *Banshee, this one "silver," is shown on routine test flight. An All-Weather fighter, the new twin-jet Navy Banshee carries greatly improved radar, more powerful armament and increased internal fuel capacity over previous Banshees*

M. Sullivan: "Even at the present time, g just our terminal radar, we have found ecessary to have our Watch supervisor ch out the interval between successive roaches in order to permit departure air-t to get out of the airport. Strange as it seem, because of the airport's configura-itself, we use Runway 13 and Runway 7 e frequently in conjunction with Runway uring IFR conditions. From the time an lane starts its roll to the time it crosses way 4 which is a Landing Runway, the rage is 55 seconds."

ave Little: "*With your permission, I'd like efer discussion of that item.*

To summarize this meeting, I take it we are in pretty complete agreement that:—

1. The basic fundamentals of radar traffic control are entirely satisfactory and very desirable;

2. We're making a long-needed move in the right direction.

However, we recognize that:—

3. We are pushing bottlenecks further away, not completely eliminating each, and much remains to be done.

We also recognize:—

4. The desirability of specific action toward more positive identification of aircraft in and under radar control;

5. More and better radar as regards seeing through heavy precipitation;

6. Possibly the need for and procurement and use of altitude-indicating radar when available;

7. Need for early commissioning of the planned ground VHF-ADF equipment plus direct pilot-controller VHF communications.

8. Plus radar beacons on all aircraft operating into heavy terminals.

We also look forward with interest to:

9. Improvements in commercial or civil available ground radar through lower frequencies, circular polarization;

10. We hope for a change in civil air regulations requiring all traffic in high-density areas to be controlled to eliminate the borderline weather hazards which we have today."

The Hell of It

Many years ago I was flying my Dizzy Three and we got caught in some lightning storms at night. The air got as rough as a chorus girl's back and the new stewardess, a capable lass in her heart and mind, found her body couldn't take it, not yet at any rate. She became airsick and so I went back into the cabin to see if our passengers were securely belted in. One of them was a man of the cloth and he was praying with fervor as well as abandon.

"Don't you have confidence in me?" I asked.

"Yes," he replied, "I have confidence in you as a pilot, but I suspect where you are going." Hy Sheridan

'Copters for Business

(Continued from page 20)

in complex traffic and social problems. The continued enlargement of key terminal airports, or the development of new airports farther away from large population centers to insure safer operations and unrestricted space for take-offs and landings, has and is proving a serious financial burden for the taxpayers. The helicopter, naturally, cannot be heralded as the panacea for all of these difficulties. Its utility and versatility, however, particularly when larger multi-engine transport and cargo types become generally available, certainly will help to relieve this perplexing and troublesome development in air transportation.

With acute surface congestion in metropolitan areas, time-consuming circuitous routes to and from airports, taxi, limousine and bus fares comparatively high on a per-mile basis, the time-saving value of the helicopter is obvious for airport shuttle to and from downtown and suburban areas and for inter-airport shuttle.

Although the helicopter is still a lusty infant in the commercial and industrial field of air transportation, it is playing an increasingly grown-up role. Some of its everyday business chores include mail, passenger and cargo carrying, crop dusting and spraying, insect extermination, gas and oil pipeline patrol, checking electric transmission lines, exploring for oil and mineral deposits, fighting forest fires, aerial photography and mapping, carrying personnel, equipment and supplies to remote mining and hydro-power projects, conducting timber surveys, untangling complex traffic problems, overseeing cattle ranges, and a multitude of other useful operations. As in military operations, its inherent ability for slow and low flight, hovering, and maneuvering into and out of tight places, provides unique advantages that are almost completely lacking in other means of transportation.

There is a sphere of commercial and industrial usefulness of the helicopter which is still virtually untapped. This virgin field lies in corporation or executive-aircraft operations. But, you may ask, "What could the helicopter do more effectively than the fixed-wing aircraft is now doing?"

The helicopter, of course, cannot and should not be compared in its present stage of development with fixed-wing aircraft, especially in connection with long-haul transportation. The unusual flight characteristics of the helicopter do, however, give it a distinct time-saving and economical advantage for short-haul corporation flying and eventually may offer attractive possibilities in the long-haul field.

As you well know, the helicopter is basically one of the safest modes of air transportation yet produced. Only severe weather restricts its flight. Since it incorporates a free-wheeling device permitting the blades to auto-rotate, power-off landings are rather routine. Since it also can take-off and land in a space hardly larger than its own structure, it needs no highways, no airstrips, or little in the way of landing facilities on land or on water. Furthermore, its operation requires only a minimum of air navigational aids and weather service. By possessing all of these novel features, rotorcraft can't fail to offer material advantages for corporations desiring relatively swift, dependable and economical point-to-point short-haul transportation between plants and from plants to metropolitan areas.

During the past five years, the swift and unhesitating acceptance of the airplane for corporation use has startled the aviation industry. By purchasing aircraft, both large and small organizations have angled indirectly into the aviation field and they are finding it unusually beneficial to their business and prosperity. Perhaps the most important asset, offered by corporation-owned and operated aircraft, is the saving of time for top executives. As a rule, these men are able to be in and out of off-airline airports quickly and comfortably. In many instances, the geographical and physical location of various organizations enables them over a period of time to reduce travel costs by transporting personnel in their own aircraft.

Usually, it is the initial cost of purchasing and maintaining an airplane, hiring a pilot, and defraying operation costs that deters some organizations from entering this field.

Although a few executive aircraft were winging the skylanes over 25 years ago, this segment of civil aviation didn't begin to mushroom until just after World War II. At that time, hundreds of surplus aircraft were quickly and cheaply bought by corporations that saw the advantages of air transportation in conducting their business.

Frequently, the question is asked: "Why all this corporation flying?" The answer is a simple fact. Since transportation is a basic requirement in conducting practically any business, particularly if the interests of that business are widely scattered, then the mode of travel must be fast, economical, comfortable and flexible. The airplane certainly meets all these needs.

Today, there are at least 4,000 airports in the United States that presently can be [illegible] by most multi-engine airplanes. Yet only about 400 communities are served by scheduled airline transportation. Many of them have inadequate rail service which further complicates travel if airline reservations are not available. Immediately you can see the advantages of the corporation-operated aircraft that can fly executives where they want to go, when they want to go, without the problem of time-tables, checking in, waiting for baggage, changing planes or trains, and the other inconveniences, nuisances and delays connected with usual forms of travel.

There seems to be an erroneous belief that the bulk of corporation-owned aircraft are in the same category as a yacht—simply an expensive luxury. That such is not the case, is evidenced by the rapidly growing number of companies and corporations buying and operating their own aircraft. These owners are daily proving the benefits of aircraft ownership. I might say that operating costs to them is not an unknown factor—it is a very real factor, and the economy of their aviation operation is the rule of the day and the yardstick of its success. In a detailed survey recently conducted by CAOA, practically all of the owners indicated that their aircraft were used strictly for business purposes, and the larger organizations reported that 300 to 600 different employees were using their aircraft from time to time. One company even reported that over 2,000 different individuals in their business had used their airplane at one time or another. Our survey also showed utilization anywhere from 350 to 950 hours per year, with the average being around 596. When all factors are carefully weighed, corporation airplanes are providing the safest and most economical means of transportation for top executives.

From time to time different CAOA surveys of the organizations using their own airplanes indicate that the convenience of being freed from time-table restrictions as well as the ability to reach off-the-beaten-path localities is of prime importance. As one official of a large farm machinery company recently put it: "When we fly to another city for an important conference, it is nice to know that we don't have to keep our eye on the clock to be sure of catching a certain plane or a particular train. We know that whenever we finish with our business, we can drive out to the airport, relax, and fly back to our home port in safety and comfort. Also, it is of considerable importance to be able to complete business missions in the same day. We think nothing of scheduling appointments in Columbus, Ohio, or Chillicothe, Missouri, in the morning, and a dinner engagement at 6:30 in the evening of the same day back at home."

With all of this increase in corporation flying, you might gather the impression that it is a competitor of the scheduled airlines. I understand that some airline officials

(Continued on page 46)

We'll Take Taxes

Peter Barnett and Tony Weeks who fly for Pretoria Flying Services, Pretoria, S. Africa, sent in this item, culled from the NOTAMS issued by S. Africa's Dept. of Commercial Aviation:

Mala-Mala. Warning!

At present there is a large number of lions, including one lioness who has cubs, in very close proximity to the aerodrome. Should any pilot within the next 6 or 8 weeks land at Mala-Mala, he should remain in his aircraft until met either by the owner or his manager who will be appropriately armed. To stress the danger, the owner points out that the lions chewed up all the shovels and picks left on the aerodrome one afternoon.

because you'll like tricycle gear

Because the tricycle landing gear rolls straight *automatically*, it gives high performance aircraft the simplest, easiest ground handling characteristics possible. That's why every modern airliner, every jet airplane has this type of gear.

And that's why the fast, far-ranging Piper Tri-Pacer has this safety gear, too. It's the finest insurance for your aircraft investment. You don't worry about cross-winds, or ground-loops. You don't have to stall to land. You can operate in higher winds: you see much better taxiing. Take offs and landings are virtually automatic!

So preponderant is the preference for tricycle gear that the Tri-Pacer sells 14-1 over the Pacer still available with the old-type tailwheel landing gear for special purpose flying.

And so enthusiastic is the flying public over the 1953 Piper line of fast, quiet, economical 4-place business planes and the famous, versatile Super Cub that Piper production is now higher than that of any civil aircraft manufacturer in the past five years.

For speed and comfort with *economy* nothing matches the new 1953 Tri-Pacer. See it, fly it at your nearest Piper dealer's.

One of three great improvements for safety, utility and flying ease

ONLY THE PIPER SUPER CUSTOM TRI-PACER has all these features plus two-way VHF radio, 2-band LF receiver, homing loop, full instrumentation and gyros, over 125 mph cruising speed — still $3,000 less than any other 4-place plane not even as fully equipped! Send for new full-color catalogue, Piper Aircraft Corporation, Lock Haven, Pa. Dept. K 3

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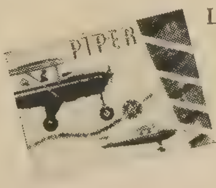


ORE PEOPLE HAVE BOUGHT PIPERS THAN ANY OTHER PLANE IN THE WORLD

'Copters for Business

(Continued from page 44)

believe that we were taking business away from them while others admit that we have contributed more business. As Al Smith used to say: "Let's take a look at the record." In almost every organization that owns and operates airplanes, the amount of scheduled airline travel has increased tremendously. In the farm machinery company previously mentioned, this has amounted to over 700% expressed in dollar volume. When they started operating their first airplane, they had 25 airline travel credit cards. Today they have well over 300. Of course, a portion of this increase in airline travel would have come about normally along with the general growth of air transportation. CAOA, however, has interviewed over 100 people in the business and found in about 90% of the cases, that those who had not been traveling by airlines before had their first introduction to air transportation in the company plane.

One reason that the general public and even people in aviation have not fully comprehended the extent to which this new and rapidly growing mode of transportation is being utilized is that corporation owned and operated aircraft have the most outstanding safety record of any form of transportation. Consequently, there are seldom any glaring headlines about major accidents. In 1951, fatalities for corporate aircraft averaged 0.5 per 100 million air miles traveled, compared with 1.30 of the domestic airlines and 2.44 of automobiles. The figure for 1952 is expected to be even lower for corporate aircraft. Such a remarkable safety record is proof enough of the high qualifications and excellent equipment flown by corporate pilots.

Whatever the reasons, it is now obvious that corporation flying definitely is here to stay. The corporate aircraft fleet today numbers over 9500, or nearly one sixth of all civilian aircraft throughout the nation. During 1951, corporate airplanes flew nearly three million hours and it is expected that this figure was exceeded by the end of 1952. When you consider that corporations are flying more hours than the domestic scheduled air carriers and have a total of passenger seats in excess of those of the airlines, then the horizon looks even brighter for continued progress in this new segment of civil aviation. This everyday use—under all conditions of weather—is winged evidence of industrial adaptation of the air age to its own needs and purposes. This is as it should be for the rapid growth of American industry has depended largely upon technological developments.

Most of the 1800 corporate-owned multi-engine airplanes operating today are actually better equipped from an instrumentation standpoint that many of the scheduled airliners. Also, since they operate under practically the same weather conditions and are using equipment similar to the airlines, their needs so far as the approach and landing area itself is concerned are directly comparable to those of the scheduled airlines.

Since we now are living in an age of decentralization of industry, and unprecedented growth of large population centers, this forces both a lateral and vertical revamping of our travel pattern. The solution for this complex combination would be virtually impossible to attain except through aviation. And the only apparent fundamental solution on the horizon is the use of helicopters designed to perform a specific mission.

Although I am not prepared to offer any slip-stick prophesies regarding the rapidity with which corporations will adapt helicopters to their aviation operations, I will venture to point out that certain-far-sighted and large organizations already have accepted the "flying windmill" as a valuable asset to their present and future business activities.

The Rockwell Manufacturing Company of Pittsburgh, Pennsylvania, for example is convinced that the helicopter is the answer to its need for quickly moving company personnel and parts from one plant to another, scattered throughout Pennsylvania and Ohio. Rockwell Manufacturing has purchased an S-55 for scheduled short-haul operations out of its Pittsburgh factory. According to Mr. W. F. Rockwell, the helicopter can depart a 100-foot square landing site at the main plant and land at the DuBois plant in about the same time that it requires to reach the local airport by ground transportation. For travel to plants located at greater distances, the Rockwell organization uses fixed-wing aircraft based at the Allegheny County Airport.

Another staunch advocate of helicopter utilizations is the United Aircraft Corporation. Three of its four divisions—Pratt & Whitney, Hamilton Standard and Sikorsky Aircraft—are located in Connecticut. Since these divisions are widely dispersed, the helicopter is proving of great value in management and corporate supervision. Also, personnel and critical parts can be swiftly shifted from each division at a substantial saving in time and expense.

United also employs a helicopter for air-taxi service to municipal airports, thus reducing the delays of ground transportation and insuring prompt airline connections. Two of the Pratt & Whitney sub-divisions, located approximately 40 minutes driving time from the central plant, can be reached in less than 10 minutes by helicopter.

The foregoing are typical examples of helicopter utility and diversity. Multiply these examples by the hundreds of corporations that could readily adapt rotorcraft to their business activities and a sizeable and lucrative commercial and industrial market appears on the horizon. I am reliably informed that in the past few years nearly 500 helicopters have been purchased by organizations engaged in such enterprises as engineering, petroleum, construction, chemical products, utilities, and many others. The utilization factor is reported to run about 500 hours a year which is comparable with the average

oration utilization of fixed-wing aircraft. a recent personal spot check of key A members around the nation, regard-their concept of the role of the "flying mill" in corporation air transportation, esting and informative data was col-d which may readily be classified into main categories. The first is:

IRBORNE OPERATIONS—To create spread corporation interest and desire wn and operate a helicopter, such air-must be proven to be thoroughly safe reliable and its operating costs must in on reasonable terms with the initial hasing price. In conventional aircraft, y things have been compromised to at-higher speeds. Over the years, this has ed rather costly in terms of dollars as as lives. The safety factor of the heli-er is of utmost importance to prospec-corporate owners, since any major dents involving rotorcraft might result igh insurance rates and other hampering rictions. Any adverse national publicity rding a series of helicopter accidents d put a strangle-hold on commercial insion of the helicopter industry.

nother important consideration is the ty of the helicopter to operate under eme weather conditions. Much has been to perfect the helicopter for instrument t, including installation of customary rument equipment, special rotor attitude cators, and autopilots. However, much remains to be accomplished in this . The inherent instability of the heli-er is a prime factor to be reckoned with it is certainly not insurmountable. Heli-er pilots frankly admit that it requires a of work to fly on instruments but the must not be overlooked that the heli-er is no less stable in contact flight. To n the present high degree of operating bility of the helicopter, some sacrifices to be made in control simplicity and sing speed to gain its outstanding flight acteristics. Consequently, the industry is ronted with solving the problem of op-m performance under instrument con-ns before a large commercial and in-rial market is assured.

n extensive program has been worked by the Los Angeles Airways, Inc. on in-ment flight technique and they are con-ing their pioneering investigations and rimentation.

the past year, considerable progress also been made by helicopter manufacturers mproving the flight characteristics of product. Every effort has been exerted rd eliminating reliance on the electronic ck box."

ill another important item concerns the re size, capacity and propulsion of heli-ers for commercial and industrial opera-. Sikorsky and Piasecki represent the two ciple design variations in contemporary copters—the single rotor (Sikorsky) vs. dual-rotor (Piasecki). Three models ently are certificated by the CAA for mercial operations. Two are of the three-200-hp type and one of a 10-place 600-hp type. The smaller models have a 150- to 200-mile range at cruising speeds from 80 to 100 mph and a rate of climb around 1,000 fpm. The larger model has a range of about 500 miles at about the same cruising speed. In the next several years, it is anticipated that newer transport types capable of carrying up to 20 passengers at cruising speeds of 120 mph may become available with single and tandem rotors and in single and multi-engine configurations. These helicopters, should prove most interesting to corporations desiring to supplement their fixed-wing aircraft fleet. It is also widely known that other multi-rotor and revolutionary type configurations are on the drafting boards. Sikorsky is said to be preparing to produce a twin-motored transport helicopter capable of carrying 30 passengers. Piasecki, on the other hand, has a military contract for two experimental 40-passenger transports. One is expected to be powered with a turbine engine. In both cases, the heretofore negligible payload factor has assumed great significance and it will definitely influence the future commercial and industrial development of the helicopter.

The second main category is:

GROUND OPERATIONS—The unique

(Continued on page 48)

'Copters for Business

(Continued from page 47)

characteristic peculiar only to the helicopter which permits it to take off from and land on a fixed point is of utmost importance to corporation flying. In most instances, small heliports could be located within plant property. Either an area on the lawn near the administration offices, a section of a parking lot, or part of a roof top providing ready access to the building, could be quickly and easily converted for helicopter use. In general, if the plant layout permits, a roof top operation probably would be the safest and most, efficient from a traffic and obstacle point of view and, in the long run, more economical in light of the usual scarcity of open lots of proper size and location in the vicinity of large industrial plants.

The acceptance of transport or cargo helicopters into corporation flying also involves pilot training and maintenance. At present, helicopter piloting and mechanic training is available through various independent operators as well as the manufacturers. It has been proven that anyone capable of piloting fixed-wing aircraft can easily become a helicopter pilot. Also an adept A & E mechanic soon can proficiently service and maintain the 'copter.

Since the helicopter's regularity of operation will have to be comparable or better than that of the fixed-wing aircraft, visual and instrument flight control assumes great importance. The wide divergence of opinion regarding the air navigation aids required for safe helicopter operation under varying weather conditions has spurred recent activities by the Federal Government, the helicopter industry and operators of commercial helicopters. An extensive testing program is being set up by the Helicopter Guidance Committee of the Air Navigation Development Board. Initially, an examination will be made of existing air navigation aids. Studies will include air traffic control, communication procedure and the technical aspects concerned with radio aids to enroute and terminal air navigation, approach and landing procedure, traffic control facilities and communications equipment. In brief, the main objective is to study the adaptation, modification, or supplementation of the Common System to accommodate the VFR and IFR operation of helicopters.

Numerous changes also will be required in aviation law for maximum use of helicopters. The Federal Government, states, communities, and the people must recognize that the helicopter is not an airplane but is a unique type of air vehicle. To be successful in the commercial and industrial field, its use should be subject to a minimum of safety regulations in accordance with its diversified operating characteristics.

So that the helicopter may prove the full extent of its utility, existing laws, ordinances, rules and regulations must be reviewed and modified as required. Heliports should be established freely and zoning laws enacted to permit virtually unrestricted operation in industrial areas. Nor should nuisance laws be enacted under the convenient guise of public safety.

With several helicopter types now available to corporations to perform a variety of useful jobs, it appears only logical that those organizations not presently utilizing the unusual flight characteristics of rotorcraft should carefully survey their operations and determine just where they would best serve them. In such a survey, the remote base and subsidiary requirements should not be overlooked. For swift, reliable and safe short hauls, the helicopter certainly has no equal in present-day air transportation.

To further stimulate interest in the value of the helicopter for commercial and industrial use, I would suggest that joint studies be made by the helicopter industry and the Federal Government along these lines:

1. Most efficient types of transport or cargo helicopters currently available, or combinations thereof, to meet basic corporation operational requirements, including delivery price, direct operating costs, maintenance requirements, availability of replacement parts, etc.
2. Several inexpensive types of heliport designs, with approximate cost of development and construction.
3. Desirable locations in industrial areas for regular and alternate heliports for prospective corporate users, taking into consideration communications, visual and instrument flight operations, airspace and airways, flight altitudes, take-off and approach control, and other related factors.

It is up to helicopter manufacturers to convincingly prove the utility and versatility of the helicopter for commercial and industrial use before a profitable market can be developed.

This article would be remiss if it did not also mention a new and radically different type of aircraft which its enthusiastic proponents believe will bridge the gap between the helicopter and the fixed-wing airplane. This projected air vehicle is supposed to incorporate the advantages of the helicopter with the speed and range superiority of the fixed-wing airplane. The convertiplane, as it is called, employs the helicopter principle for take-off, landing and low-speed operation, and performs as an airplane for higher speed and longer range. Such a configuration appears to have possibilities in the field of corporation flying, although it is doubtful whether it would ever replace either fixed-wing or rotary-wing aircraft.

As I mentioned earlier, new devices successfully serving mankind seemingly have appeared in a sequence of evolution—first the idea and then means for material accomplishment. But one thing is definitely settled now as far as the helicopter is concerned—it has found a unique place in the vast air-transportation picture and is proving its right to be recognized in all present and future national air planning for commercial and industrial use.

de Havilland Heron

(Continued from page 17)

ing characteristics, combined with four-engine safety and low operation costs are likely to endear it to the many corporations who find their present DC-3's a little on the large size for executive transports and not quite economical enough. Already firm orders for more than 30 *Herons* have been placed.

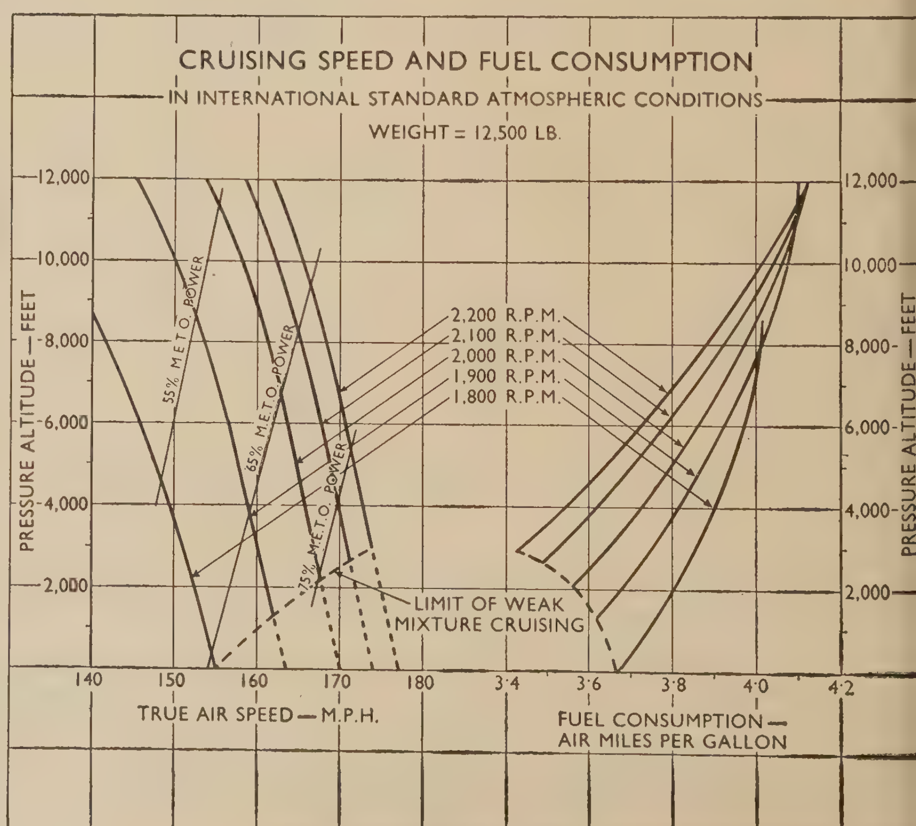
The *Heron,* though larger, is somewhat simpler than the *Dove,* and one's first impression of the machine is that of a large *Dove,* the over-all characteristic lines of which have been successfully retained; increased fuselage length and wing span providing the necessary scaling-up without destroying the appeal of the original twin-engined airplane's contours. As in the *Dove*—itself an airplane "designed for maintenance" and from the operation of which the *Heron* has benefited—the policy of the design team has been to provide in the *Heron* the simplest possible layout. The extent to which simplicity has been achieved is unusual in a modern airplane of the *Heron's* size and, as we have already suggested, may lead some to decry its more unusual design features as anachronisms.

The use of direct-drive, unsupercharged Gypsy Queen 30 engines (250-bhp), two-blade, non-feathering props and fixed landing gear are all features which result in a marked saving in initial and maintenance costs. The contribution made towards simplicity by each of these features is self-evident, but their effect on the *Heron's* cruising economy is not so readily apparent.

The 1,000-size bracket-type constant-speed propellers are an obvious choice for an airplane such as the *Heron* in which basic simplicity is the keynote. Although the ability to feather a propeller in the case of engine failure is desirable in order to gain the best possible three-engined performance, as was anticipated, the take-off and performance characteristics of the *Heron* leave an ample safety margin with one engine *out,* without the refinement of feathering props. In cost, ease of maintenance and weight, the non-feathering propeller scores heavily, and in the case of the *Heron* the extra weight of four fully feathering props would amount to the equivalent of one passenger.

Measured performance figures have shown that at the maximum all-up weight of 12,500 pounds, and under International Standard Atmosphere Conditions at sea level, the climb rate with the most critical engine windmilling in coarse pitch is 595 ft/min, while under the same conditions of atmosphere and loading at 5,000 feet, the *Heron* climbs comfortably at 320 ft/min. In order to comply with normal airline procedure, the take-off safety has been fixed at 87 mph at which, with full load, the *Heron* climbs away readily on any three engines; in fact, during flight trials the airplane with full load has been flown off from a standing start using less than 1,000 yards of runway.

It can be seen that the *Heron* has an ample power reserve and that the added weight, cost and complication of feathering propellers could not be justified on the score of performance. There is, of course, another advantage to feathering in that it enables a damaged engine to be brought to rest, preventing further damage. The windmilling torque imposed on the engine is relatively



ipproximating that of a man cranking tomobile—and the windmilling speed irse pitch is moderate. Provision has made for turning off the supply of oil ividual engines, and if it should be im- ve to stop rotation, the cutting off of l supply will stiffen the engine up suf- ly to bring it to a standstill.

or Retractable Gear. . . .

standard *Heron* has fixed landing gear ler to eliminate the weight and compli- of retracting mechanism, but the Series *ron* now under test has fully retractable In considering the fixed gear, it should membered that the *Heron* is designed rily for short-haul duties of the order) miles or less. A penalty in speed due ding gear drag on such stage lengths is ;ible in both time and cost. The suc- f the low-drag fixed gear is illustrated *Heron's* comfortable cruising speed of ph at 60% power. From the pilot's view- a comparison is best drawn with the which, with landing gear lowered and raised, has a sharper gliding angle than f the *Heron* with its fixed undercarriage s flaps lowered 20°.

r stage lengths of up to 400 miles the f retractable landing gear would, by 1 of the added weight, bring about a te payload reduction with only a com- ively small advantage in speed. For ex- , over a 200-mile stage length retract- gear would reduce payload by one hun- pounds and reduce stage time by *four- -half minutes.*

order to simplify flying procedures, the les and propellers constant-speed units been interlinked to a single control lever ch engine; a system which also reduced ction costs by enabling the *Dove* throttle which has provision for two throttles and prop control levers, to be used in the 1. Although appearing on the surface to flexibility and cruising efficiency, this n does, in fact, provide a considerable e of control flexibility which is achieved arrangement of cams which varies the ve movement of the throttle-butterfly ne C.S.U. according to the control lever's on in the quadrant.

e levers are moved to the forward stop ake-off, in which position the throttle- rfly is fully open giving, at sea level, under zero boost while the constant- unit is set to give the maximum revs of Once the plane has left the ground, re reduced to 2200 by moving the levers to the climb position. The throttle-but- remains open at this setting and there s no reduction in boost. As altitude is d, with the levers in the same setting he butterfly open, the boost falls off un- igure of minus 2 lb/sq/in., is reached at 3,000 feet, at which point the weak- re setting is automatically selected.

en the *Heron* reaches the desired cruis- ltitude—5,000 to 10,000 feet, the levers ulled back further to approximately the vay position to give 2,000 revs, at which g the throttle-butterfly is slightly closed, and a movement of the control levers through a considerable range on either side of the 2,000-rpm position gives a relatively large variation of revs with only small changes in boost. A wide range of possible settings for the cruising rpm-boost ratio is thus available.

With a reduction in revs to 1800 the movement of the throttle butterfly becomes rather more marked and follows more closely the movement of the lever. When the levers are fully closed and the throttle-butterfly is in the slow running position, the constant-speed unit will be set for minimum rpm although the prop will, in fact, be in fine pitch trying to maintain speed and is, therefore, properly set in the case of an overshoot. This setting would not, of course, be desirable in the event of an engine failure, and provision has been made for a positive selection of coarse pitch by moving the lever still further back through the gate, accessible only after the release of a safety catch.

From the Pilot's Viewpoint. . . .

The handling characteristics of the *Heron* are entirely normal. Taxiing is simplified by the completely unobstructed forward view, and both wingtips are visible from the pilot's and copilot's seats. The nosewheel is non-

(Continued on page 52)

de Havilland Heron

(Continued from page 51)

steerable but the brakes are smooth and powerful and the aircraft can, therefore, be steered with precision and taxied at a fast pace. There is no swinging tendency on take-off and the throttles can be quickly opened to full power. For the quickest take-off the flaps should be set at 20°. Once in the air the *Heron* is stable laterally, directionally and longitudinally under all flight conditions within the permissible CG range. Prior to the stall there is a slight tailplane buffet as the airflow starts to break up, but there is little tendency for a wing to drop, and lateral control remains effective below the stalling speed. Indicated stalling speeds with full load are 85 mph with flaps up; 75 mph with flaps at 20°, and 70 mph with flaps down. The *Heron* can be trimmed to make a stable approach with flaps raised or lowered, and with full flap it is possible to achieve a high rate of descent. Normal approach speeds with full load are 85-90 mph with full flap; 90-95 mph with flaps at 20°, and 100 mph with flaps up.

Few four-engined airplanes can claim such a compact cockpit as the *Heron*. In main essentials it is similar to that of the *Dove*. Dual control is provided, and the blind-flying panel and other flying instruments are mounted on the port side where they are directly in front of the pilot and clearly visible to the copilot.

With the maintenance engineer the *Heron* should prove extremely popular as all items requiring routine inspection are easily reached through hinged access doors or removable panels, and the airplane's layout enables engines and propellers and, in fact, most of the airframe to be inspected and worked on from ground level. In the basic version of the *Heron* all features which experience has shown may call for specialized maintenance have been eliminated.

Constructional Features. . . .

The wing is built in one piece and is readily detachable; the single main spar being attached to the fuselage by two bolts and the false rear spar by one bolt. Aileron control can be disconnected by means of two turnbuckles reached through a panel in the underside of the wing, while the flap-operating pipelines are easily disconnected at the wing roots, where also are the electrical junction boxes. The leading edge of the wing, between inner engines and outer engines, is hinged to facilitate inspection of engine controls and pipelines, and access to the de-icing pipeline connections is afforded by hinged sections beyond the outboard engines. Beyond the hinged sections, the wing leading edges are detachable to allow for the inspection of spar structure. Holes in the rear spar, which are exposed when flaps and ailerons are removed, provide access to the wing interior.

The fuselage break-down is similar to that of the *Dove*. There are three main fuselage sections; the nose portion which extends to the rear of the cockpit; the passenger cabin, which consists of roof, base and two sides, each of which can be replaced in the case of a major repair; and the rear fuselage section, made up of two portions with the addition of a detachable tail cone. The tail cone is attached by four toggle fasteners and when removed gives access to the tail unit cont and sternpost structure. The rudder and vators are detachable without disturbing adjustment of control and trim tab cal and the elevators are interchangeable.

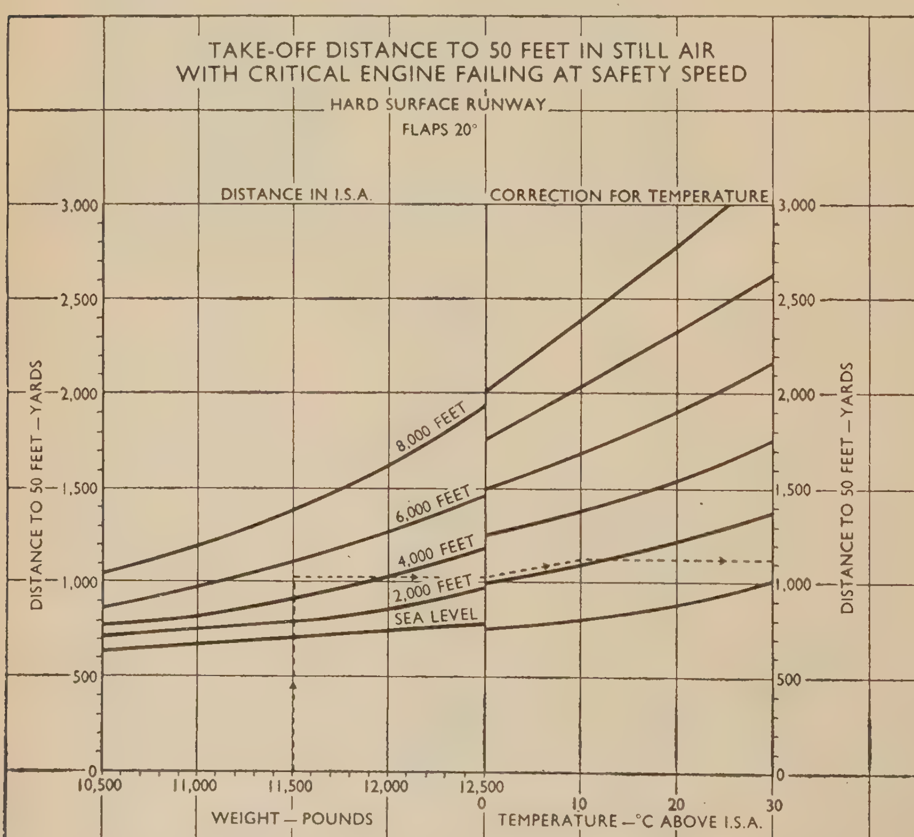
The nosewheel of the landing gear is of non-steerable type, fully castoring, wit Lockheed air-oil shock absorber strut. main legs are cantilever structures with c pression rubber shock absorbers and deta able fairings. Jacking points are embod in each leg in order that a wheel may changed without the necessity of jacking the whole airplane. The legs can be detac by means of one large nut which is access through the upper wing surface. The wl brakes are pneumatically operated.

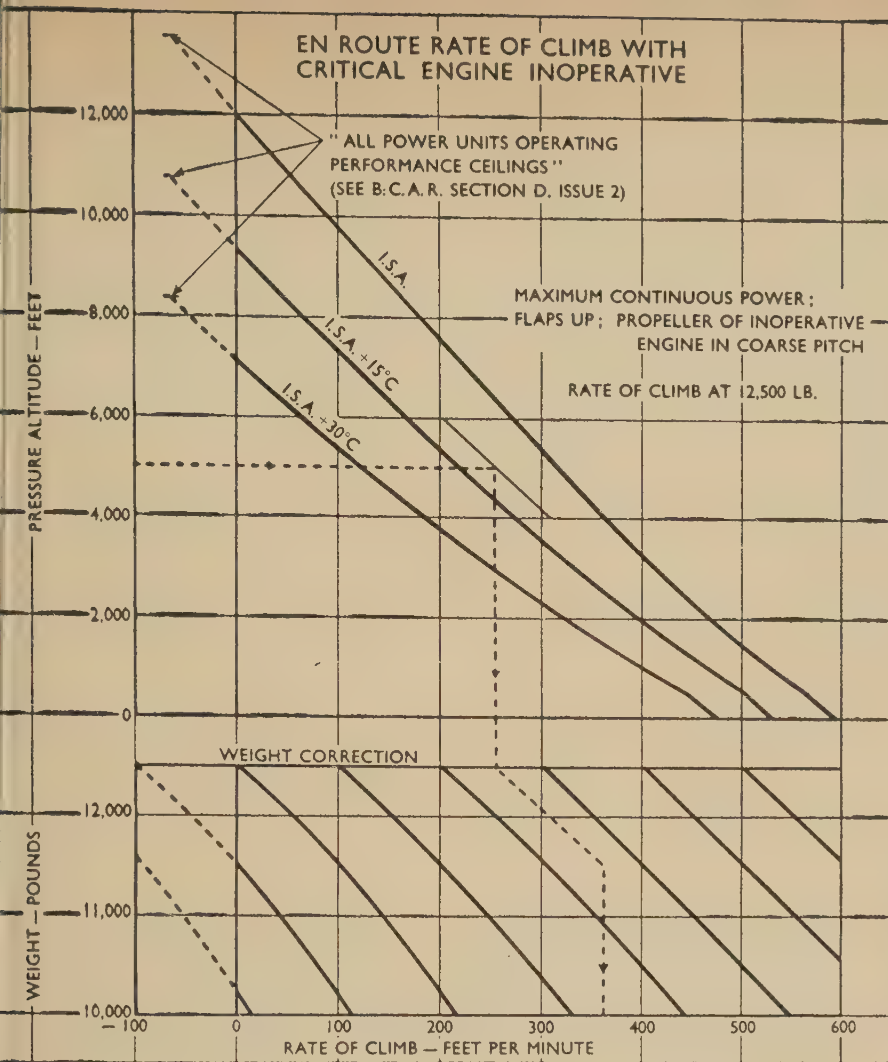
Controls are cable-operated and can be spected from outside the plane through pa in the rear bulkhead of the front lugg locker, hinged inspection doors under fuselage and wings, and by removing tail cone. Two 1,000-watt 24-volt generat one on each outboard engine, supply two cumulators on the starboard side of the n These batteries are rubber-mounted and electrical terminals are automatically gaged via spring-loaded connections.

The *Heron's* pneumatic system is supp by two air bottles mounted in the nose wl are charged by Hymatic compressors in e of the outboard engine nacelles. The hin nose cap gives access to the air bottles, pressure regulating valves and the gro charging point. Pipelines are colored coded for identification simplicity. The p matic system can be used to inflate the and the nosewheel oleo by means of charging hose. Goodrich de-icer boots fitted on the mainplane and tailplane, air feeding these is tapped from the exh side of the vacuum pump located on the board engines. The propeller de-icing f and pump are carried in the rear fusel The tank can be filled from outside thro a filler cap on the starboard fuselage s The windshield de-icing tank is locate the fuselage nose.

The standard fuel tankage consists of 122.5 U.S. gallon flexible rubber bag t mounted one on each side of the fuselage tween the spars, and access to the interio these bag tanks is effected via a detach cover in the undersurface of the wing. tank filler cap is mounted on the upper face of the wing and can be easily reac from the ground. Extra tanks can be fitte bring the total up to 379.5 U.S. gallons.

A variety of seating layouts for the *H* exist and 14-, 15-, and even 17-seat vers are available, but of greatest interest to operators will be the Executive model w will provide accommodation for eight pas gers. The appointment of the cabin incl facing pairs of seats consisting of adjust armchairs which, by means of interior-sp auxiliary cushions, can quickly be conve into comfortable couches. Also fitted folding tables which may be used full w or without the center leaf (thus leaving gangway clear). Because of the space a able in the *Heron* cabin, it has been pos





include many refinements such as lockable binets for light personal luggage as well as nging space for overcoats.

The Series II version of the *Heron,* with a tractable undercarriage, is now undergoing itial tests, and calculations based on the easured performance of the *Heron* Series I th fixed landing gear and same all-up eight indicate that this model will have a uising speed increased by some 15-20 mph, the expense of an increase of 110 pounds empty weight. It is over longer stages that e *Heron II* will show to better advantage. r stage lengths exceeding 250 miles, the ving in fuel due to the increase in air-miles r gallon will more than balance the extra eight of the retractable landing gear. For ample, over a stage length of 700 miles the yload will be increased by 115 pounds and e stage time reduced by some 25 minutes. ne maximum stage length with full long-nge tanks will be increased by some 125 les. The other aspect of the performance be materially affected by landing gear re-action will be the *enroute* climb rate on ree engines which will be increased from 5 ft/min to about 700 ft/min at full load der I.S.A. conditions at sea level.

The *Heron* has been certificated to B.C.A.R. oup 'A' and Group 'C' standards—the for-er ensuring compliance with ICAO International Transport Category "A" recommendations. When operating at an all-up weight of 12,500 pounds in I.S.A. conditions, the Series I *Heron* with fixed landing gear has the following performance:

Take-off: Distance to 50 feet in still air at sea level from a hard runway with flaps set at 20° (with all engines functioning), 685 yards; (with failure of critical engine at safety speed), 780 yards. Distance to safety speed, 495 yards. Accelerate-stop distance if one engine fails at safety speed, 1,090 yards. Take-off safety speed 91 mph.

Climb: Rate of climb at sea level with flaps at 20° (with all engines functioning) 940 ft/min., (with critical engine inoperative and its prop windmilling in fine pitch) 400 ft/min. Enroute rate of climb at sea level, 1,125 ft/min. (with critical engine inoperative and prop windmilling in coarse pitch) 595 ft/min.

Speed: Cruising speed at 65% M.E.T.O. power at 8,000 feet and 2,100 rpm.; True Airspeed, 165 mph. Fuel consumption, 50.44 U. S. gallons per hour.

Stalling Speeds: With flaps up, 89 mph; with flaps set at 20° (take-off) 79 mph; with flaps set at 60° (landing), 71 mph.

Landing: Distance from 50 feet in still air at sea level onto a hard runway with flaps set at 60°, 665 yards.

Panel Lighting

(Continued from page 13)

that are diametrically opposite. First, it has been proved that legibility of dials, pointers, and markings increases with size, contrast with background, and brighter light. But the pilot can best see objects outside the cockpit when the cockpit is totally dark.

To try to climb down off the horns of this dilemma—necessary brightness on one hand and necessary darkness on the other—engineers studied the rods and cones in the human eye. The cones are the nerve endings in the center of the eye, or fovea; the rods are the endings outside the center. In daylight, these rods and cones are equally sensitive to light, but at night only the rods react when brightness levels are very low.

Now the energy of different wave lengths affects the eye to different degrees; some wave lengths or colors do not affect the eye at all. For example, certain large amounts of ultra-violet light per unit time cannot be seen. That's why, during WW II, ultra violet was used to activate fluorescent pigmented paint on instrument markings. Engineers thought that because the pilot could not see the light source, his dark adaptation would be perfect. But the lack of contrast made the instruments appear to "float." And the fluorescent image hung on—"fluorescence of the eyes"—so that the pilot saw multiple images.

But a light emitting wave of 600-770 millimicrons in length (red) can be turned high enough to make instruments visible to the rod nerve endings, yet be almost invisible itself to the foveal cones. So it would seem that a red light of low intensity focused on the instrument panel would best light the pilot on his way. Psychologists, however, have found that many factors beyond the light source itself affect the eye in its struggle to adapt to darkness. For example, according to Chapanis, Garner & Morgan, in *Applied Experimental Psychology*, at night you see larger surfaces better than small ones. And the brighter the light, the better you see. As for contrast, the greater the contrast between a pointer and its dial, the better you see it.

Yet "surround contrast" should be slight. In other words, in looking at a dial our eyes are most sensitive when a large area around it is the same brightness or a little dimmer. For best acuity, "surrounds" should not be less than one-tenth as bright as the central field. Therefore, size of instrument marking, brightness, contrast, and "surround" must be considered in designing the most "practical" instrument panel lighting system. Yet in practice, optimum settings for each of these items is in conflict with operational requirements.

What are the requirements of the pilot who must see dimly lighted objects outside his cockpit?

Fred R. Brown, physiologist, and Capt. J. R. Poppen, former Superintendent of the Navy's Aeronautical Medical Equipment Laboratory, say that there should be a minimum of direct view of the light source to cut glare and reduce attention localization.

Console areas, where switches and circuit breakers are located, should be about as brightly lighted as dial faces. In other words, brightness variation must be kept to a minimum. Yet the brightness level—of console area and dials—should be adjustable. And finally, the brightness contrast between the lighted units and their background should be great enough to prevent "floating."

Building all these visual requirements into a system that is efficient as far as size, weight, and complexity go, has been impossible.

There have been stopgap attempts. For instance, to prevent reflection from instrument covers, manufacturers have tried to find non-reflectable glass. Other attempts that are catalogued in the files of the Flight Safety Foundation include grooving the cover glass and installing the gauge so that it faces down.

Closest approach so far that the executive aircraft pilot can install himself is the "false panel" system. In this system a false panel, with holes cut out to match dial faces on the original panel, is placed about three-quarters of an inch in front of the original panel. Red lights behind the false panel spread a fairly even glow of light that "leaks" out from between the two panels and lights the dials.

Console areas are lighted by the trans-illumination, or plastic surface lighting technique. In this technique, engineers shape the panel, paint it black, then notch such labels as "rich" or "lean" into the plastic and paint them with translucent white paint. Red lamps placed in the plastic send light through it laterally. Light is invisible behind the black paint on the face of the panel except at the notched letters. By day, then, labels appear as white letters against a black background; by night, the labels glow red against black.

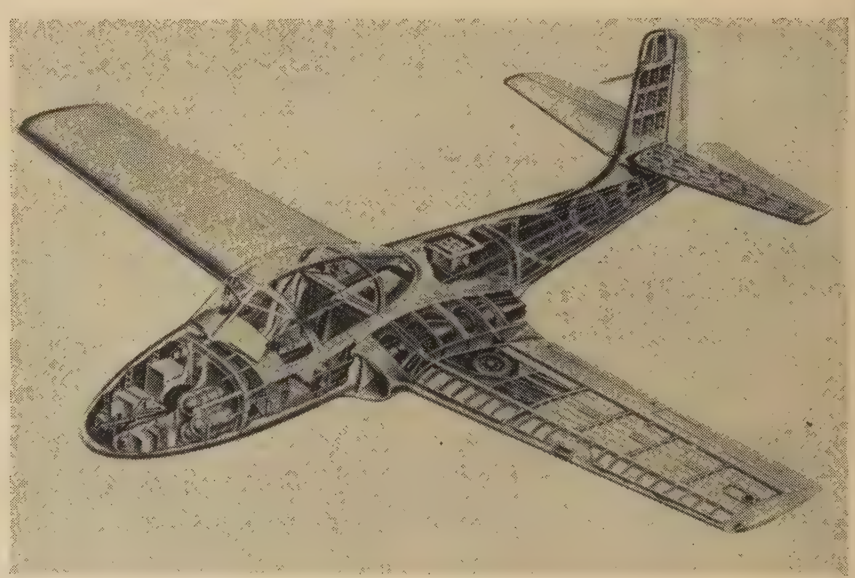
Still the false panel and trans-illumination systems alone are not enough. Complementary floodlighting is also necessary. Tests at AMEL on the XAM-2 cockpit mockup show that of a group of Naval Aviators, more than 50% preferred a combination of trans-illumination and low-level floodlighting on console areas.

Floodlighting is necessary to increase visibility in important areas—it was wanted especially by inexperienced pilots. Besides insuring adequate light for areas around important switches and circuit breakers, low-level floodlighting improves the pilot's "feel" of the cockpit by showing him the spatial relationship of panel and side consoles. It prevents "floating" of dials and pointers. And it helps to reduce the contrast between the dial and its surround.

To pilots who install such systems in their executive aircraft, Brown and Poppen recommend that floodlight illumination level be controlled from the same rheostat so that the floodlighting will be uniform. And the floodlight should be the same color as the indirect light to prevent what is called the "fluttering heart illusion," *i.e.* "dancing" of the dials because of different retinal latency periods for different colors. Floodlighting is practical from a safety viewpoint, too. If the false panel or trans-illumination systems cut out, the flood lights can be used alone.

So the false-panel-trans-illumination-floodlighting system is one of the best—if not *the* best—system that the business aircraft pilot can install in his boss' plane. For those business pilots who want to install such a system, AMEL in a brochure entitled *"Proposed Draft For Plastic Lighting Plate Marking and Control Design"* makes these points:

To simplify fabrication, to improve lighting uniformity, and to allow for flexibility in design, subdivide the console panel into several small panels. A maximum area of 60



CESSNA *has been awarded AF contract for development of jet trainer (above) designated by Cessna as Model 318. Design gross weight will be 5600 lbs: top speed over 400 mph. It will be powered by two Marbore 352 jet engines built by Continental*

is recommended, even though several
anels will be mounted on one base.
ps should be placed with three-to-
ch centers since light is distributed at
onably high and even intensity only
a circle of about a two-inch radius.
ing lamps in the plastic sheet, remem-
at control shafts coming through the
vill cast shadows.
lows are but one of the many disad-
es in the plastic surface lighting sys-
First, the plastic sheet itself presents
difficulties. It must be thin and light,
must support the lamps and their fix-
To date, Sierracin, a product of Sierra
cts Co., seems to fill the bill best. It
Military Specification MIL-P-7788, does
ze as do acrylics, and features a lumin-
ht transmission of 90%.
ation of the lamps determines uniform-
light, yet the arrangement of the in-
nts may be such that they get in each
way. Thus, even the light on any one
nent may be uneven.
use the instrument dials are "sunk"
e false panel, a "well" effect results,
ting the pilot's angle of view. And once
lse panel is set up, rearrangement of
nents or installation of instruments of a
nt size is impossible without cutting an
y new panel.
EL, by the way, offers these operational
in thunderstorms, forget the straight
ht cockpit and put on plenty of white
o counterattack lightning flashes.
ember that all-red cockpit lighting
to erase the red lines on charts.
finally, remember that it takes 30
es of total darkness for the eye to reach
ximum dark adaptation. In 30 minutes,
e's sensitivity increases 10,000 times.
plastic surface lighting, too, has its
tion and—reflecting the state of flux
instrument-panel lighting is in—it is
y undergoing changes. Also, other sys-
re continually being offered.
of these systems, produced by Glow-
Corp., is a condensed indicating-warn-
stem which projects to a translucent
only that portion of the original dial
area of the pointer. Chief advantage
by using a light beam and optical sys-
he display, regardless of the size of the
al instrument, can be as small as one-
ch square. Take cylinder head tempera-
or example; instead of a pointer on a
swinging around an entire dial and
ng at different numbers that indicate
linder head temperature, a disc with
ers on it rotates. And the observer sees
hat segment of the disc which shows
tual temperature. He sees it as a num-
a translucent screen through which
s shining.
wmeter's system has certain definite ad-
ges. Most important one is that the dis-
area can be reduced as much as 90%
e. The display area can also be re-
d to a point nearer the pilot's cone of

ctral reflectance, or glare, is eliminated
se light is projected to a translucent
screen. Illumination can be kept very low, increasing the pilot's dark adaptation. And the entire group of mechanisms can be packaged and sealed.

But like most lighting systems that have been offered to date, an alternative source of power is required in the event of failure of the lighting supply; in this case a relay cuts in energy from a small mercury battery. Another precaution is the use of double filament lamps.

Another solution has been offered by International Instruments, Inc. Their Model 150 round case meter for indicating such items as generator voltage output are sealed units with a glass window at the rear of the case. Light passes through the window, over a specially developed miniaturized D'Arsonval movement and is diffused over a translucent scale. Again, glare is eliminated because there is no external source of light in the cockpit. But again there is a drawback: instruments such as gyros do not readily adapt themselves to this type of treatment.

Putting light *inside* the instrument might solve the problem, but with this system, lamp size is limited.

So masked individual external fixtures for each instrument may well provide the best solution to the panel lighting problem. Kollsman, Sperry, and Grimes have produced such lights or marks to date. The Grimes model has been accepted as standard equipment by the Army and Navy.

Through use of such masks, uniform light is thrown over the entire panel since each instrument is lighted by two lamps of equal wattage and several instruments are tied to the same rheostat.

Lamps are located in the upper part of the instrument outside the cover glass. They are covered by a mask which is hinged and can be pulled down quickly for replacement. Lamps are GE 327's, recently put on a mass production basis for the armed forces.

The two lamps throw light downward through a red filter over the cover glass. Glare and reflection are minimized.

As we pointed out, however, this system is already so complicated that Grimes has been unable to standardize on fewer than 85 different fixtures. Again reflecting the continual change in the battle to improve panel lighting, Lewis B. Moore recently announced that Grimes' light masks are already undergoing major modification. Moore believes that the modified masks will be ready shortly, however, and that Grimes will be ready soon to go into mass production for the armed forces and business aircraft owners.

But John M. Roper, a former lighting engineer in the Navy Department's Bureau of Aeronautics, feels that even such light shields are but an interim measure. He says that instrument redesign alone can solve the lighting problem. And Fred R. Brown of AMEL agrees to the extent that he believes that changing the markings on the dials and consoles may provide the best solution.

As Harry A. Cramer said, there may be no practical solution, but engineers and psychologists are narrowing down possibilities.

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Let's Analyze . . .

(continued from page 21)

wants. The engineer on the other hand can only tell us whether or not it is possible and practical to make one indication or another. This is not meant to belittle either of these men, but rather to point out the specific part of the program in which they should participate. The only practical way to get proper results from the people responsible for aircraft design is to have them work as a team, each covering his particular field of endeavor. Such a team requires a pilot for requirements, an engineer to determine the technical feasibility, and a psychologist and physiologist team to determine with the other two, the proper, most natural method of presentation and design.

Even more important than this team, however, is the necessity for a guide. Such a guide would be in the form of a set of operational requirements covering each phase of flight and would establish where we are and where we should go. It is rather easy to point out the weaknesses and inadequacies of our present instrumentation as well as to establish the research and development required to take care of these deficiencies, by using such a set of requirements.

For example, let's look at the first phase of any flight, the take-off. Let's further assume that this is an instrument flight in order to determine exactly what information must be provided in lieu of visual conditions.

The first bit of information required is the alignment with the runway. Here the pilot is concerned with his position with respect to the center line—not heading as given by a directional gyro or compass. Heading alone will not tell him where the edge of the runway is as he starts to run (Fig. 1). In contact weather this information is apparent and easy to use, so in some way we must find a method of simulating this same data for instrument flight conditions. Thus we now have our first basic requirement—lateral position on the runway. No pilot can truthfully state that this is not necessary information. It is true that we make instrument take-offs without it, but it requires a great deal of concentration and continued practice.

The second requirement is position with respect to the length of the runway (Fig. 2). In

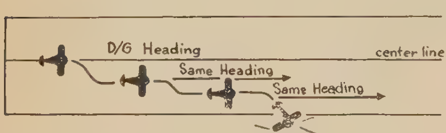

FIG. 1—*Using Directional Gyro for position could result in running off the runway*

other words, the question asked by the pilot is, can we get airborne before we get too far down the runway? This becomes very critical when operating from fields with short runways, in aircraft with high load and low lift characteristics. This requirement may not be a necessity at all times, but it would relieve the tension of the pilot, and it is still a basic piece of information.

Number three requirement is the indication of obstacles at the end of the runway (Fig. 3). Here again this may not be a must, but it would ease the pilot's mind and would speed

FIG. 2—*During VFR, pilot gets both lateral and longitudinal position cues quickly*

up the traffic control problem. Possibility of other aircraft or obstacles ahead is one of the factors which is always on the pilot's mind when flying instruments.

In making a take-off we can improve our economy of fuel as well as performance if we get the gear up as quickly as possible. This would then establish a requirement for some

FIG. 3—*Obstacles that can be seen clearly on contact should be indicated on IFR*

indication as to when we are safely airborne. This may seem far-fetched, but it is one of the things which every pilot is taught from the beginning, "Reduce the drag as soon as you can. Get your gear up."

As we climb-out, other factors that have to be known are: attitude and altitude; direction; airspeed; *safe* rate of climb; *safe* or *adequate* power setting (Fig. 4): and *proper*

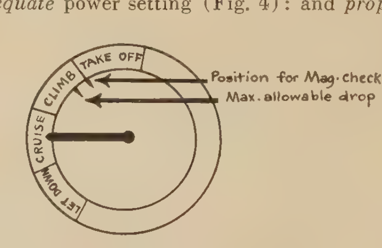

FIG. 4—*Instrument that tells proper power setting at a glance is a requirement*

engine condition. In each of these the requirement calls for two things—is it proper, and if not, what should I do?

To summarize, we find that for take-off we must know the following:

(1) lateral runway position
(2) longitudinal runway position
(3) ground clearance
(4) obstacle indication
(5) safe and proper rate of climb
(6) safe or adequate power
(7) safe airspeed
(8) attitude
(9) direction
(10) altitude

It can be seen that the above requirements are not based on the type of instrument or control, but rather on what information is needed to carry out this phase. It can also be seen that some of these requirements are not being fulfilled satisfactorily in present-day aircraft. It can be stated then that instrumentation for take-off is not fully adequate. It can be further stated that before an instrument panel can be standardized, these requirements must be met by additional data.

Now the question comes up as to where we can put any additional instruments. The answer to this is that we can't add any more instruments, but instead, we must integrate our present information in order to make it adequate. It is quite feasible to build instruments to combine information but unless these combinations fulfill our requirements they will complicate rather than simplify

One solution would be to determine by analysis, all of the basic requirements for each phase of flight. Such an analysis is not difficult if pilots are interrogated as to what they look for in making a visual flight. It will be found in making this analysis, that with very few exceptions, all pilots look for the same basic things. Since the pilots will be in agreement as to what is needed, personal opinion will be replaced by factual data and the first step toward real standardization will be achieved. If the engineers and psychologists follow this same guide, they will both be working toward the same goal, and the ability to fulfill these requirements then rests only in the state of the art.

You who are aircraft owners can take part in the problem, too, and from you might we come useful suggestions that would be helpful to the eventual solution. Analyze your own airplane to determine the adequacy of the instrument panel. Rule a sheet of paper as suggested (Fig. 5), and use the illustrated chart as your guide. Set up charts for take-off, navigation, normal flight, approach to field, landing and let us know the results.

There are many projects under development which may solve any or all of the problems of adequate data presentation which are unknown to the author. In any event, the en

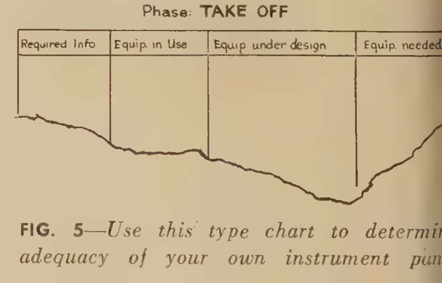

FIG. 5—*Use this type chart to determi adequacy of your own instrument pan*

solution to the problem of standardizati lies in the ability to analyze the job and coordinate all efforts into one integrated pr gram, the end goal of which is flight on i struments as easy as under VFR.

The opinions or assertions contained here are the private ones of the author and are n to be construed as official or reflecting t views of the Navy Department or the Na establishment at large.

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Lockheed F-94C

(Continued from page 11)

said that the cooling unit for the F-94C is the equivalent of having 14 home-size refrigerators at work doing the same job. And, for warmth, the heating unit is reported to be capable of heating a five-room house.

Sometimes I'm asked what it feels like to lift the nose of a *Starfire* off the deck and then just start climbing. Well, believe it or not, I've found the sensation less stomach-shaking than riding in an elevator. The ears pop a little, but you're as comfortable as you are when sitting in the living room at home. The pilot doesn't have any particular awareness of the earth suddenly dropping out from under him. Frankly, he's too busy to be looking around to notice.

Like everything else nowadays, when science and technology combine to develop newer, faster, more advanced machines, the know-how required to operate them becomes greater—particularly when you're a jockey for an airplane which will hit a high Mach.

As to what an F-94C pilot has to know to fly his ship proficiently, that's something different. When you're operating a nearly automatic, near-sonic ship—with a multitude of instruments and gauges to watch—you've got to know what makes it tick at all times, and you've got to be on the stick.

The pilot of a ship like the F-94C is, in many respects, like a doctor. The doctor knows the human body, what makes it function, and what to do when something goes wrong. The pilot is doctor-diagnostician-surgeon to his ship. He has to understand it, what it can or cannot do. And, equally important, what he must do, with split-second decision, if an ailing symptom shows up.

As important in his own right as the pilot, and just as necessary a part of the three-unit *Starfire* team, is the radar-operator. Without him, and the highly specialized equipment which he operates, the performance of the ship and function of the pilot could be wasted. Both he and the pilot have full-time jobs—there's plenty to keep them busy.

Once an F-94C has been alerted and then scrambled to the attack by the ground control interceptor unit, radar moves in. Airborne, and screeching upward for altitude, *Starfire's* crew is told the height and direction of the approaching "bandit" by the ground radar operator. He guides them until the ship's RO picks up the blip of the invader on his radar set, a console model which sits right over his lap.

From the time he notes the blip on his screen the ship's RO is in the saddle. His directions guide the pilot and plane to the point where the pilot can see the target—or, lacking visibility, until the pilot's own scope tells him he is on target and in range.

Once in firing range, the pilot presses his rocket-release trigger and then—at the proper moment determined by the automatic firing computer—the rockets are spewed forth.

Powered by a Pratt & Whitney J48-P-5 jet engine with an afterburner, the *Starfire* offers exceptional performance, the details of which are under strict military wraps. Engineers contend that the afterburner shortens a fighter's climbing period to such an extent that the fuel consumed by both afterburner and jet engine in climbing to 40,000 feet is about the same as would be used by the jet engine alone in reaching the same altitude. The time saved by accelerated performance is thus a bonus. There are two particularly interesting experiences, from my point of view, connected with flying a *Starfire*. One has to do with the sensation you feel when the afterburner is kicked in. It really boosts your acceleration. I've often thought that the feeling should be similar to the one a motorist would have if he was stopped at an intersection, waiting for the go signal, and suddenly—Wham!—some car had rammed into his rear end and jolted him forward. When the afterburner kicks in, you get that feeling of a powerful shove forward.

Just 180° apart from the sensation you receive when the afterburner takes hold is the feeling the pilot experiences when the F-94C's drag-chute is released, shooting back and pulling the ship to a quick halt on landing.

You might be interested to know that the F-94C is the first American production fighter aircraft to have a drag-chute installation. The chute is a decided safety factor in that it greatly reduces landing distance, thus s ing wear on tires and brake installations fact, pilots can land the F-94C without us their brakes except for taxi turns and st ping on the ramp.

While the pilot's work is certainly s plified in many respects by the mass of au matic and electronic equipment packed i the plane, he has to be checked out, good, in how his mechanical aids opera

Hydraulic and electrical systems of *Starfire* are considerably more involved extensive than were those in conventio engine fighters. Many instruments have th own inverter and alternator systems. The no doubt that the jet pilot has a lot more cope with, AC and DC-wise, than his c ventional-engine counterpart had.

An all-rocket interceptor, the *Starfire* pa an awesome punch. No less staggering is amount of work which went into design the ship. I've talked with Lockheed engine about the plane from every angle. They built into it what they believe, after years research and experience gained in produc the F-80 and T-33, are the very best featu for a jet all-weather fighter.

Take the thin, straight wing for examp They believe its aerodynamic advantages credited with adding several knots per h to the ship's speed. The wing design t into consideration the ship's over-all perfo ance—climbing, diving, straight and leve every type of flying. Hall Hibbard, Lockh vice-president—engineering, says that straight, thin wing averages about 8% bet for all-around performance.

The fuselage of the F-94C embodies all the rugged features of its predecessor j plus some of its own. The aft body sectio so constructed as to permit attachment three bolts, allowing easy and rapid access the engine.

Well, that's the *Starfire* team. A ship—b to a flyer's taste, rugged, powerful, depe able, fast, potent, and with brains of its ow a radar operator—who figures out from mass of electronic equipment how to re the objectives; a pilot—captain of the s and the man who controls the Sunday pu they all went upstairs to deliver.

(Continued from page 57)

Navigation NAVICOM Communication

uency Changes Pose
pment Problems

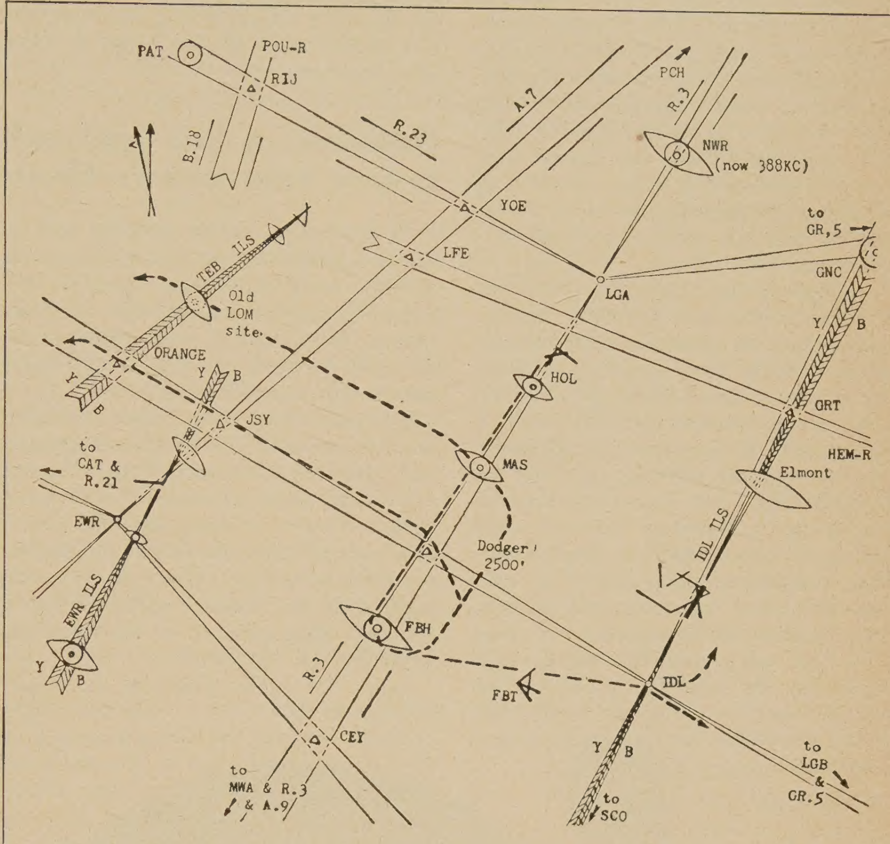
of the greatest problems facing
of the nation's airways is the in-
g complexity and multiplication
edures and communications neces-
facilitate operations without ex-
e delay penalties.

air-carriers, despite all the advan-
of mail subsidy, have been hard
l to keep up with the demands of
pidly changing program. The non-
riers, principally the business and
ation aircraft that fly as much or
of the airways under the same con-
s, have an even more despairing
unless steps are taken to arrest
end so evident today. The pilots
-carriers do not have to concern
elves with budgetary problems
the advance of IFR and ATC
ques compel the acquisition of
quipment or replacement of re-
purchased and expensive "old"
nent.

executive pilot usually cannot
lvise his company that equipment
purchased last year at umpty-ump
nds of dollars and advertised as
test and final word, is now either
te or incomplete and that, to main-
n efficient and safe operation, must
nked and replaced, or must be
to at an additional investment of
-ump more dollars. The technical
nations about frequency conges-
and highly complicated route tech-
s do not impress corporation comp-
rs.

non-airline business users of the
ry's airways have not been remiss
uipping themselves with the latest
odern radio navigation and com-
cation equipment. Evidence of this
fact that an outstanding majority
se aircraft were fully equipped to
e Victor airways well before the
1st deadline of last year. Neverthe-
hese airways have not been imple-
d except in isolated instances, and
admittedly obsolete navigational
ies have not been replaced, because
of the scheduled air-carriers have
quipped themselves to operate via
latest modern facilities.

stals for the professional-type
ment cost not less than $20 a piece;
for crystal-controlled transmitting
receiving equipment range from
0 for so-called "low-cost" 12- and
annel sets installed, to almost $10,-
or multi-channel systems now indi-



Purpose of proposed new departure routes (Southwest take-offs at LaGuardia) is to facilitate ARTC movements into and out of LGA, IDL, EWR and TEB when South winds compel back-course ILS approaches at IDL and EWR. Departure aircraft must attain minimum of 2500 ft. at Dodger int. before proceeding away from the intersection

cated as the probable "minimum" for the immediate future. In addition to the problem of purchasing, and carrying around (for probably 5% usage) an unlimited number of crystals, is the fact that most present-day multi-channel equipment carried in the under-12,500-lb gross weight aircraft is not designed for easy pilot-change of crystals in the limited number of crystal jacks.

Pilots of aircraft over this gross weight class must resign themselves to purchase of 180 - 360-channel equipment and over 300% "dead-heading" of frequency channels to insure enjoying the advantages of expeditious IFR handling accorded the air-carrier flights.

This could be worse. At the RTCA meeting of last March, Les Barnes of the ATA suggested that the CAA "require that all aircraft have the equipment necessary to use these procedures (direct contact with all airways centers, departure control routes, inbound flow control, etc)" or be banned from IFR flight into high density areas. He did not mention that they were often the sole non-governmental interests represented at the meetings that determine what procedures, frequencies (and hence, equipment) will be required to operate into each high density area.

Fortunately, most tower and airways station functions can still be utilized by employing certain "common" calling frequencies available in all current VHF equipment regardless of cost. Only such advanced and high-density area procedures as direct Center control and radar departure control require simplex channels that may not be available to the "common" user. Most of the non-airline aircraft flying the airways IFR can receive by crystal or variable tuning, the entire band of 118.7 mc to 126.7 mc,

(Continued on page 62)

Frequency Changes Pose Equipment Problems

(Continued from page 61)

announced as the interim requirement for the current few years. If the Centers and other special control agencies would adopt the tower and airways practice of guarding a "common" calling frequency for aircraft not yet able to equip themselves with the multi-multi-channel equipment, less delays to these aircraft and thus to other aircraft behind them might ease some of the problems of ATC and the pilots without any further suggestion of attempting to ban portions of the taxpayers' airways to selected portions of the taxpayers! An occasional Center has tried this.

It might be interesting to note that the current allocation of VHF communications channels throughout the country follows a fairly loose pattern, thinking now of airways and ATC usage. The old announced pattern of 118-mc band for Tower, 119 mc for Approach Control, 120 mc for Center, 122.2 mc and 126.7 mc (replacing 111.1 mc) for airways stations is no longer adhered to for very valid reasons of interference at higher altitudes, congestion, etc. The CAA, who have performed feats of legerdemain in trying to exact free channels for all purposes, have had to exchange and reassign frequencies all over the country. For your guidance, the following frequencies are to be found at the following number of facilities: (approx.)

118.1 mc (Intn'l)	22	120.1 mc	3
118.3 mc	43	120.3 mc	17
118.5 mc	8	120.5 mc	3
118.7 mc	33	120.7 mc	12
118.9 mc	7	120.9 mc	4
119.1 mc	21	121.1 mc	11
119.3 mc	8	121.3 mc	7
119.5 mc	26	121.5 mc	all (emergency)
119.7 mc	3		
119.9 mc	22	121.7 mc	2

121.9 mc . . . all (Ground Control)

122.1 mc and 122.2 mc are used cross-channel at airways stations universally.

122.5 mc is used cross-channel at all towers for civil itinerants.

122.7 mc and 122.9 mc are unassigned as yet at any facility.

122.8 mc is Unicom.

123-mc band is unassigned as yet although tried a few times for cross-channel.

124.1 mc through 124.9 mc are just coming into use.

125.1 mc through 125.9 are becoming important, especially in the New York area.

126.18 mc is still military tower VHF.

126.5 mc shows an increasing trend.

126.7 mc is used simplex at airways stations universally.

126.9 mc is unassigned.

Frequencies above this are either air-carrier company or governmental.

Bowing to the inevitable, it behooves pilots, not already equipped as outlined above, to either take the necessary action in order to continue to operate country-wide IFR, or to make strong representations via the various civil organizations such as CAOA to demand a common working frequency with all Centers and other special procedural facilities. One or two such alternate common frequencies should meet all objections of intra-area interference.

Ballistics—A New Approach to Low Approach Problems

At the last session of the 1952 IAS industry seminar held in New York City in the last week of January, possibly the largest audience of experts on any aviation subject heard a new approach to the still-rankling problem of "Why missed approaches?"

Whereas much has been creditably done to improve the quality of ground and airborne instrumentation, weather reporting, pilot techniques and proficiency, visual and other aids, the fact is still with us that occasionally even the most skilled pilots at this ticklish art do miss, and they usually start missing in the last three minutes of an otherwise well-executed approach.

Capt. Art Jenks, Chief of the Flight Inspection Div., CAA, may not have been the first to detect what may well be the "missing link", but he demonstrated at the session on Air Transport Safety, presided over by Jerry Lederer, Director of the Flight Safety Foundation, that he had gone further to develop this promising line of thought than had been done before, and that it deserved expanded research.

Basically, the natural laws of motion have never been repealed any more than the law of gravity, despite the otherwise fine state of the art which we have developed to fly like birds. Hence, the suggestion that one of the basic tenets of ballistics, or inertia—the tendency of a body in motion to continue in motion along the original path, has never been hidden from us. In our application of control forces to position an airplane on a very narrowly defined approach path and to keep it there, we have generally assumed instant (as it seemed) response aerodynamically, changed attitude and created equally instant deflection of flight path.

Art Jenks points out that it just isn't so. While we have stressed alert and early detection of deviation indications, accelerated pilot reaction times, etc., and blamed pilot, GCA controller and the other known imperfect factors, we have overlooked ballistics.

With motion pictures of flight, it was shown that for a distinct and impressively lengthy interval after the known application of control forces and the served attitude change of the airc body, there is *no* change in the ac track path through space. After this nificant delay, possibly preceeded by the aforementioned delay factors, path of the aircraft starts to curve in direction desired by the pilot.

This "turn/time" lag was measu and the conclusions reached go toward explaining why an airplane approximately 45 lbs/ sq ft. w loading, traveling 135 mph, and placed 200 feet to the side of a 200-f wide runway at one-quarter to one-l mile from the end of the runway, o cannot be maneuvered into a land position before too much of the run length has been consumed to effec safe landing.

Further out, at one and one-half m an average 5° ILS rate of bank to back to the centerline from a two deviation, results in a calculated 1 feet of inertia-resisted straight path fore the effect of the attitude cha forces build up sufficiently to start path displacement. By this time, would not be unusual for the pilot apply additional corrective action start the needle moving towards wh he wants it to go, which familiarly sults in accumulation of correction, overshoot of the course centerline.

He then applies corrective action other way, the airplane continues ward from the desired path, he tigh it up more, and bang!—he goes thro the course again, the oscillations e time becoming more violent and he cumbs to chasing the needle, if it is already evident that the approach been missed.

Capt. Jenks did not pretend to sup the answers to the development of new approach to the problem, but i cated that he felt it warranted at l as much study as has been spent on other aspects mentioned earlier. Car analysis of many flight operations, sh that 5° to 9° of bank, or a 1°/sec. of turn is a norm for ILS correcti At this attitude of the larger aircraft, wingtip is observed to be *lower* in sp than the gear, which immediately p the threat of inadequate obstruc clearance on the glide path close-in low altitudes.

Hence, the solution cannot be sim to initiate corrective off-course con action with an excessive rate and a of bank, eased off to normal rate as t becomes effective. This practice, w alluring in the early stage of the proach, could be fatal in the vicinit the middle marker and even after ual" contact with the landing run has been established subsequent to p ing the middle marker. Hence, the rently popular and highly question practice of flat skidding turns at point of the approach.

urther reported that the most crit- ne of a low approach, the transi- om instrument flight as the first positively identified until no fur- ference to the instruments is nec- which is so short to the pilot who lecide to attempt a landing or is go-around, is nevertheless quite one for the fast-moving airplane, the runway alignment is not tied at this point, it is ballistically im- e to change the flight path of the ne sufficiently to make a safe land- the remaining distance. Obvious- varies with the wing loading and aneuverability of the particular ne.

conclusion, he asked for factual rement of the "turn/time" lag at the maximum gross landing , to be included in the manufac- submitted specifications of the ne at certification. He asked that g indicators and response be im- ; and stated that lengthened ap- light lanes would make possible visual transitions at a point where potential misses could be saved. Jenks further asked that the avail- of DME equipment as an ap- n aid be expedited; and he sug- that GCA monitoring controllers be acquainted with this ballistic of the "turn/time" lag.

posium on Electronic trol and Stabilization

n open IAS forum presided over by Hon. Edward Warner, respected cil President of ICAO and well- n industry leader, the very potent t of auto-mechanisms and their in- ng part in daily air-transport opera- was given a very thorough airing. airly new term "automaticity" and plications as applied to airplane erodynamic control forces, effect on te and approach navigation, and w comfort and efficiency, were ex- led first by a panel of 10 distin- ed guests and then cross-examined the large audience which could y have been considered less expert the panel.

e panel consisted of Rear Admiral . Hall, USN, Cmdr., Fleet Air s, Atlantic Fleet; Capt. Walter A. n, American Airlines and ALPA entative; Brig. Gen. Benjamin S. y, Deputy dir., Research & Develop- USAF; E. W. Pike, Asst. to Opera- Mgr., British Overseas Airways ration; Paul R. Adams, Dr., Avia- Development Labs, Federal Tele- unication Labs; B. H. Ciscel, En- r, Minneapolis-Honeywell Regu- Co; C. S. Draper, Dr. of Instru- ation Lab., MIT; Harry J. Goett, Aero. Lab., NACA; Maj. A. L. Klein, Design Consultant, Douglas Aircraft Co.; and W. F. Milliken, Jr., Mgr, Flight Research, Cornell Aero. Lab.

One of the central themes which was repeated so often by both military and civil panel members was that the autopilot and its equivalent or associated other apparatus in the aircraft should essentially relieve the pilot of routine chores, even assuming that a low instrument approach could some day be considered a "routine chore", and not be allowed to become the basis for deliberate steps into otherwise unachievable advances which the pilot could not be expected to control manually if the automechanism should fail!

The military quite naturally regards automaticity both as a means of obtaining a stable platform from which to effect its combat activities and also as a possible means to an end in delivering a fighting unit to the desired point in space more efficiently than the human could do it, but never placing it in such a position that the thinking brain of the pilot could not change the plan as the military situation warranted.

Gen. Kelsey spoke of the "tieing together" of the automatic control activities into a system or package for one complete purpose; such an operation as was exemplified by the publicized completely automatic take-off to landing operation of large Air Force transports not so long ago. It was not specifically mentioned but the civil counterpart could be the Collins integrated flight system. Also the grouping of such controls as engine nacelle, and other operations into one or more packages functioning automatically, keyed by temperature, power or other considerations, and the pilot only monitoring to insure proper results.

Capt. Jansen, speaking as a pilot, felt that there was not yet available an autopilot that would reliably make flight safer rather than more complicated, would not act "hardover" in consequence of an erroneous signal, more reliable than the present high standard of the human element, more comfortable in turbulent flight than manual control without endangering the structure. For enroute purposes he felt that it could be considered acceptable for attitude and altitude control freeing pilot for better attention to other duties.

The BOAC representative enjoyed the novel position of speaking authoritatively on the application of automaticity to jet-transport operations, pointing out the economic urgency of maintaining airspeed to within limits impossible manually, what with the constantly shifting CG as passengers trek continually back and forth in the spacious cabin.

(Continued on page 64)

NAV-AIDS Spotlight

BRYCE CANYON, Utah—*With the commissioning of this VOR on 112.9 mc, located 267°, 9 mi. from old VAR site, the once-VAR Red Airway 6 from Denver to Las Vegas is almost all VOR. St. George VAR approaching Las Vegas should go next.*

CLEVELAND, Ohio—*BVOR relocated and commissioned southwest of Elyria, bearing 81°, 163 mi. to the airport, rather than between the marker and the field.*

COLUMBUS, Ohio—*New ILS landing west now promised for February.*

ITHACA, N. Y.—*One of first private TVOR's installed on airport at south end of Runway 32 by Mohawk Airlines.*

LOS ANGELES, Cal.—*Back course ILS approach landing Runway 7, altitude over the Del Ray fan marker is 541 feet msl.*

MIDLAND, Tex.—*Combined Tower and Insac commissioned, transmitting 278 kc; 118.7,* 119.1, 121.9 *mc. Receiving 3105 kc; 118.7,* 119.1, 121.9 *mc plus military; Approach Control.*

NEW YORK, N. Y.—Idlewild—*Two-way recording of tower and aircraft being service tested.*

LaGuardia—*Radar-assisted approach intervals expected to lower holding stacks and ease delay problems at and enroute to New York area.*

New York Center—*Improved communications reported by previously mentioned remote sites at Scranton VOR, and at West Chester (Pa.) VOR, using 125 mc band.*

ONTARIO, Cal.—*BVOR resumed operation on 117.0 mc.*

PHILADELPHIA, Pa.—*Tower frequency now 118.5;* 121.1 *mc for Approach Control.*

TETERBORO, N. J.—*Reinstallation of the MHW radio beacon at or near ILS Outer Marker site forecasted to ease Newark missed approach, LGA westbound departures, and transitions to TEB ILS, now hampering operations at these airports.*

TOLEDO, Ohio—*The LVOR (113.6 mc, keying "TOL") on the airport now commissioned for approach aid with the Genoa MHW to Runway 31.*

WASHINGTON, D. C.—*The Radar measured runway approach zone visibility resumed operation, indications directly from approach end of Runway 36 to Radar position in tower.*

WHEELING, W. Va.—*The BVOR on 112.7 mc; "HIG"; 6.8 mi. bearing 212° to Runway 21 at Wood Co. airport.*

Symposium on Electronic Control and Stabilization

(Continued from page 63)

Operationally more vital was the advantage in automatically transitioning from an instrument approach trim configuration at the point of decision to "go around" on a missed approach, to the climb-out configuration which is one of the nightmares that pilots have learned to put up with heretofore.

Mr. Draper, of MIT, pointed out that too often reliability is sacrificed for weight considerations in electronic equipment and that if the autopilots so far designed could be more reliable, the fault probably lay in this fact. He suggested that it would not be too difficult design-wise to incorporate "strain-limiters" to prevent the autopilot from responding to excessive impulses.

Major Klein, of Douglas, rocked the audience with laughter as he observed that, with all the complicated, latest automatic developments, we had failed t duplicate the success of the aborigin savage in designing an airborne weapo which once launched, if it failed to d stroy its objective, returned very efficien ly to the hand of the launcher—the si ple boomerang!

The availability of the latest, i proved designs was tied proportionat to the desire of the industry for built-i reliability. In effect, it was suggest that early, large production could l obtained only at the cost of the ve factor, reliability, which was being a tacked. As was noted, the largest airli systems were flatly prohibiting use of t present equipment, and one airline, was suggested, blamed this equipme for the inability of many of its pil to pass an ILS flight check.

Many executive and corporati crews enjoy the use of M autopilot a proach coupler and the lesson should l obvious that too little attention to man al ILS proficiency could be disastro